Enabling adaptive SAP Infrastructures with HP virtualization technologies

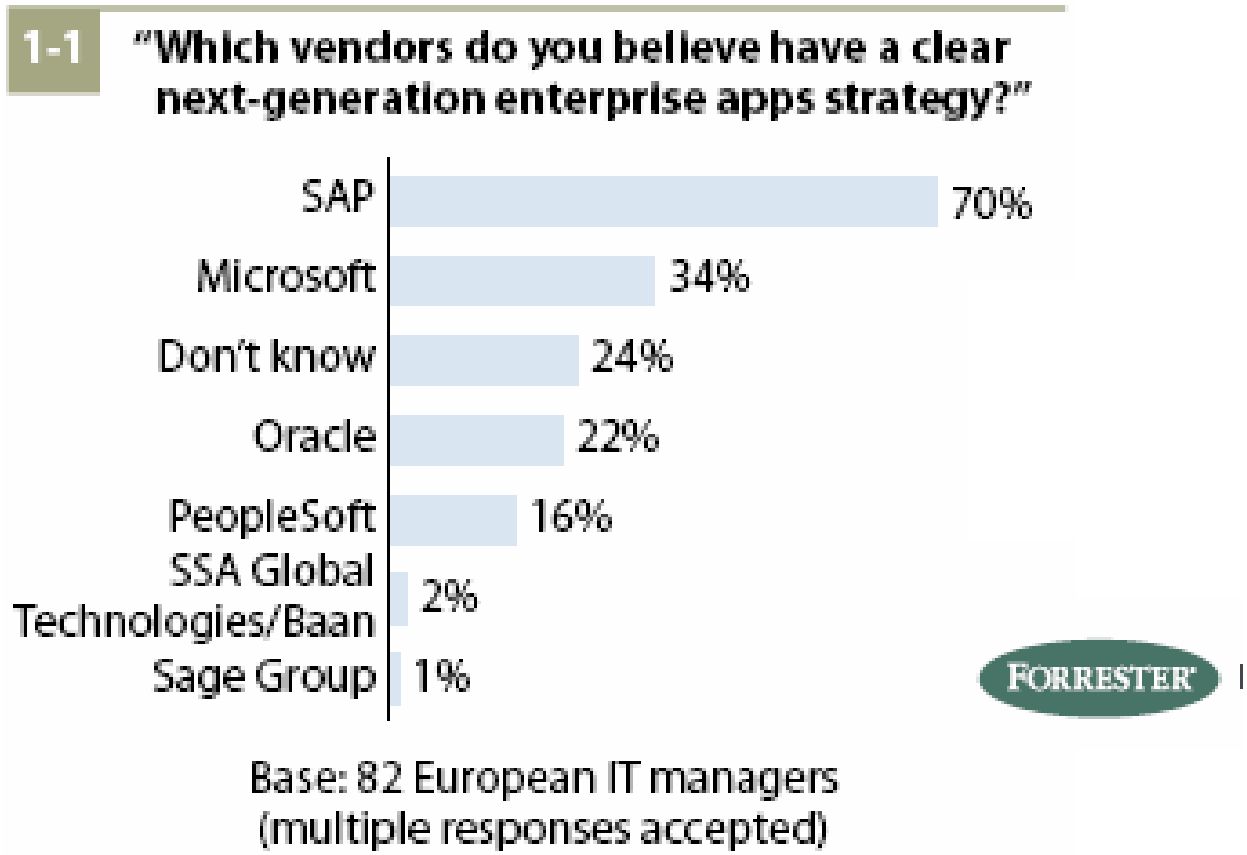


SAP HP Competence Center

20.10.05

© 2005 Hewlett-Packard
The information contained herein is subject to change without notice

Why is SAP essential?



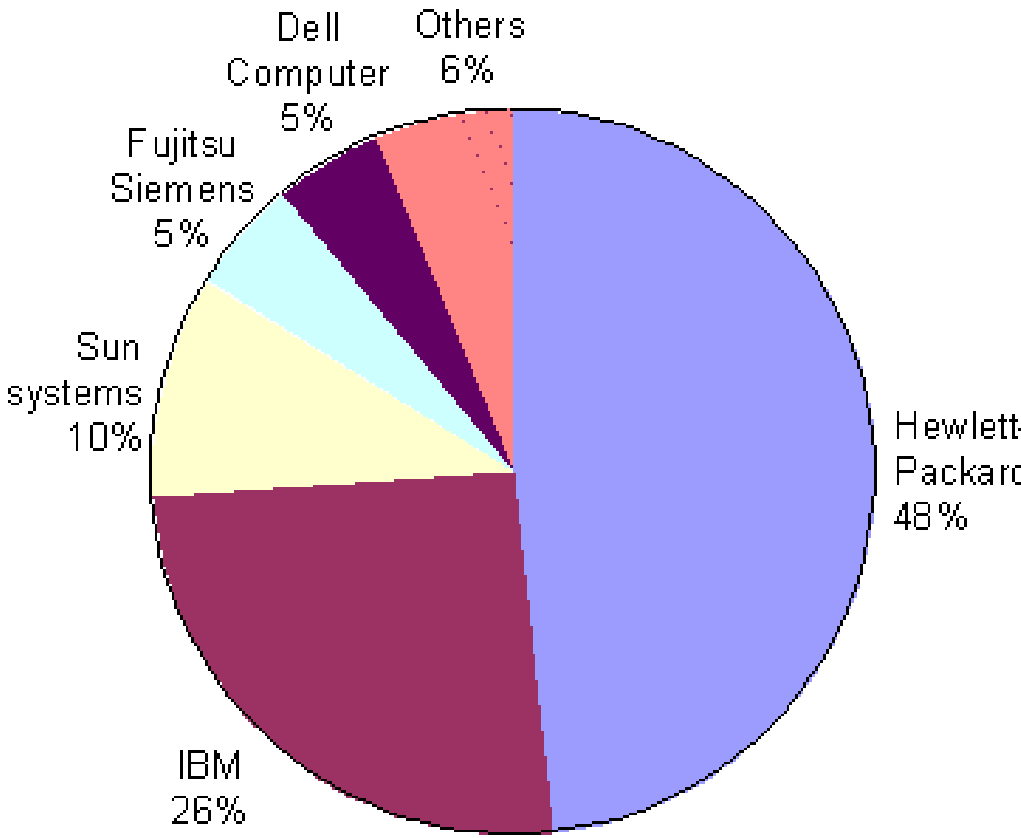
Next-Generation Enterprise Apps will impact infrastructure choices

Committed partners since 1989

HP and SAP are each others largest customers*

*in their industries

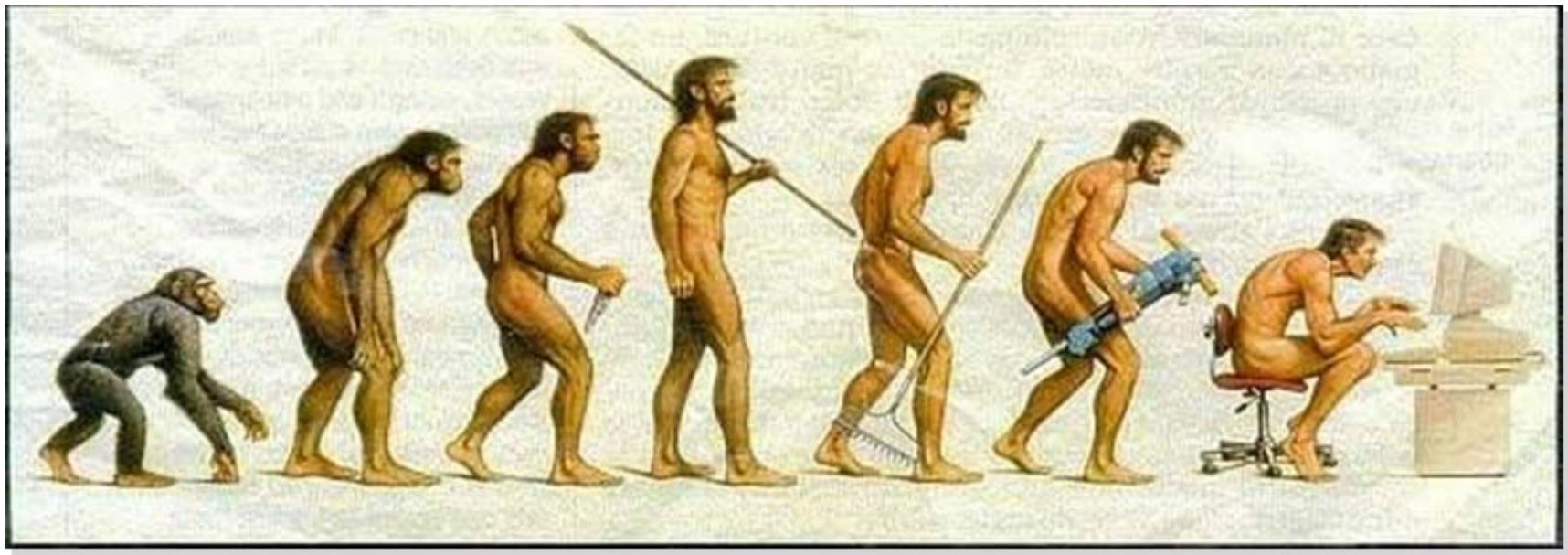
- HP runs more than 150 SAP instances and is a reference for the full SAP solution suite
- SAP uses HP servers for its mission critical IT and trusts HP services to operate its internal SAP applications
 - productive R/3 on Superdome
 - productive BW on rp8400
 - productive HR will move to DB2 on HP-UX / Integrity
 - ProLiant for product development



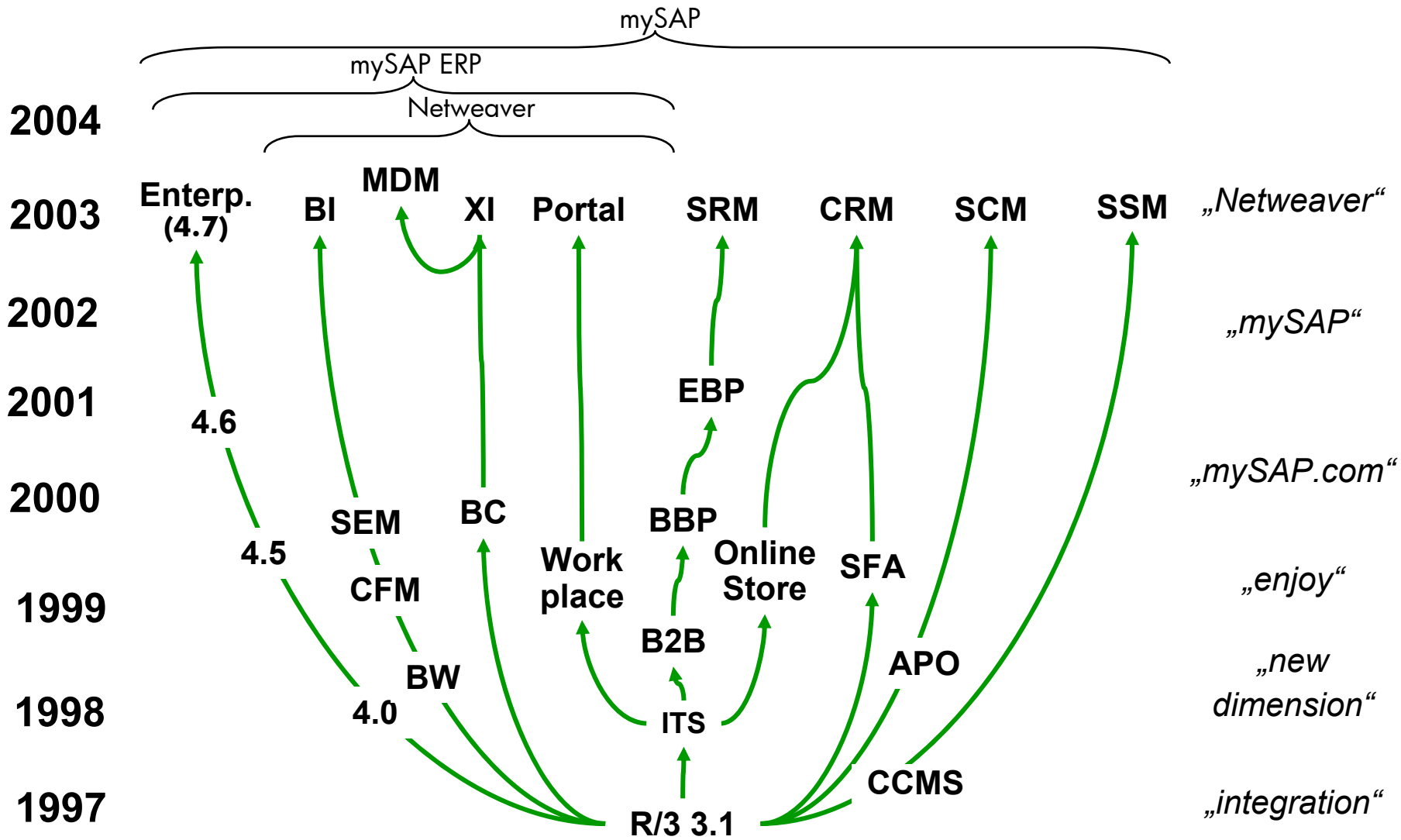
SAP Hardware Market Share

(Source: most recent Gartner Research study)

Evolution of SAP



The “roots” of mySAP solutions
(incomplete & unofficial)



beyond R/3 Enterprise - NetWeaver, ECC & ESA



NetWeaver & Business Suite in a Nutshell

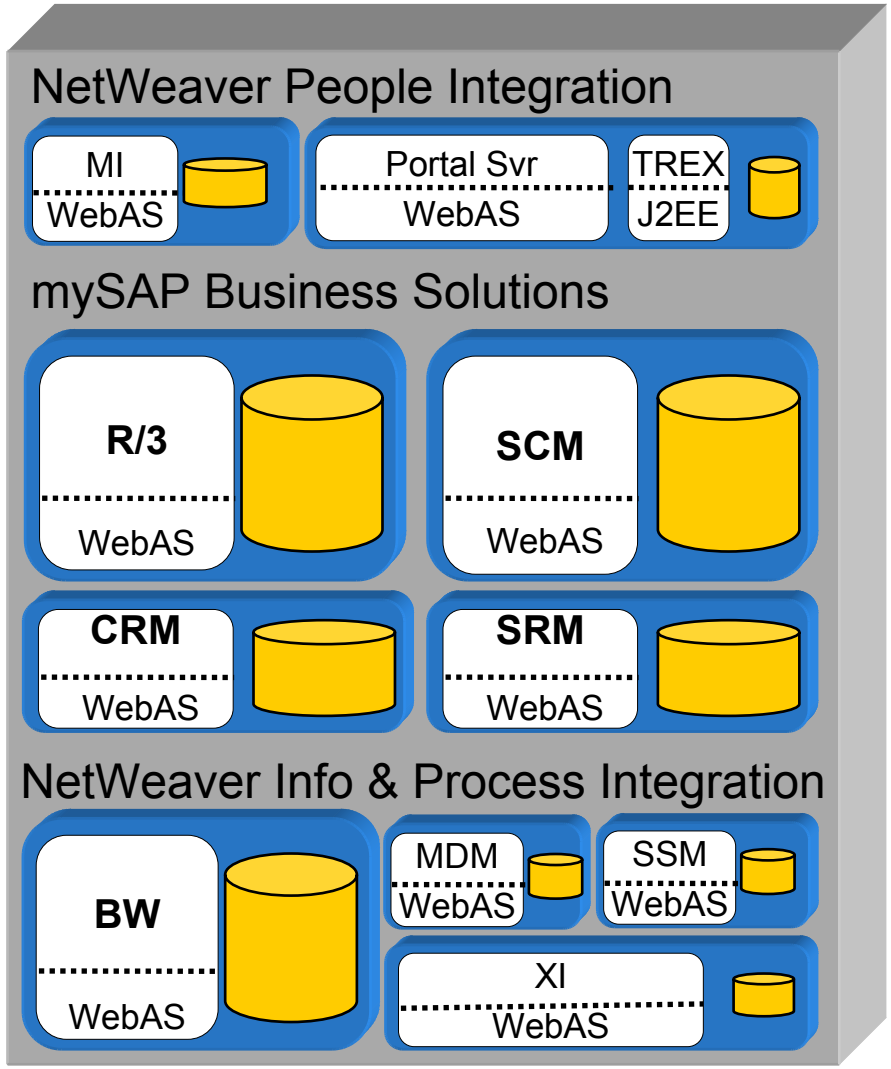
Uniform basis
Synchronized releases

Distinct App instances
SAP Web AS 6.40

Distinct DB instances
Coherent installation process

Distinct Landscapes
Integrated Components

NetWeaver solutions are "the Operation System for Global Enterprises"
mySAP solutions are "the Office Packet for Global Enterprises"



SAP ECC in a nutshell

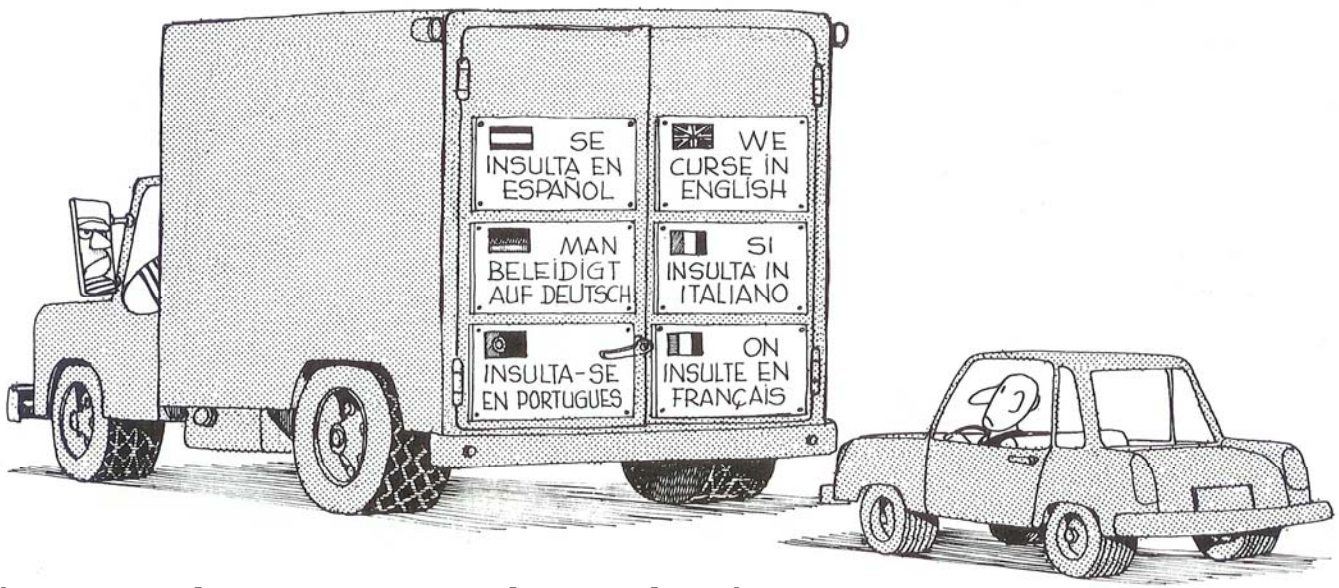
- ERP Central Component (ECC) is the technical Component which provides the core functionality of mySAP ERP
- new ERP-Engine:
 - same functionality as R/3 Enterprise, but more modularized
 - new General ledger
 - Fast closing cockpit
 - reporting by „built-in“ BW
- Integration with Enterprise Portal (EP) and Business Intelligence (BI) including functionality of strategic enterprise management (SEM) and financial analytics

- **UNICODE will replace single byte codepages and dynamic changing codepages (MDMP), today used by 10% of all customers.**

Why Unicode ?

- R/3 was designed as a single code page system Single byte code pages are limited to 256 characters
 - **English alphabet:** **~ 60 characters**
 - **Western European :** **~ 300 characters**
 - **Korean:** **~12.000 syllables**
 - **Chinese dictionaries:** **~ 50.000 letters**
 - **Unicode** **~ 90.000 characters**
 (and room for 1 Million more)
- **Browsers work in Unicode by default**
- **Java works in Unicode only**
- **XML works in Unicode only**
- **SAP note 838402: the default for new installations is the Unicode version. Unicode is also the explicitly recommended system type**

additional resource for Unicode



- **CPU's (extremely processor dependent)**
 - 30% more for old CPU's, 15% more for new designs
- **Main Memory**
 - generally 50% **make 64 bit mandatory**
- **Disk Storage (extremely platform dependent)**
 - Between 10% and 150%, generally 50%
 - **Due to the fact that a Unicode migration needs a export import of the DB, which result in a basic reorganization of the DB the Disk volume is lower after the migration in most cases**

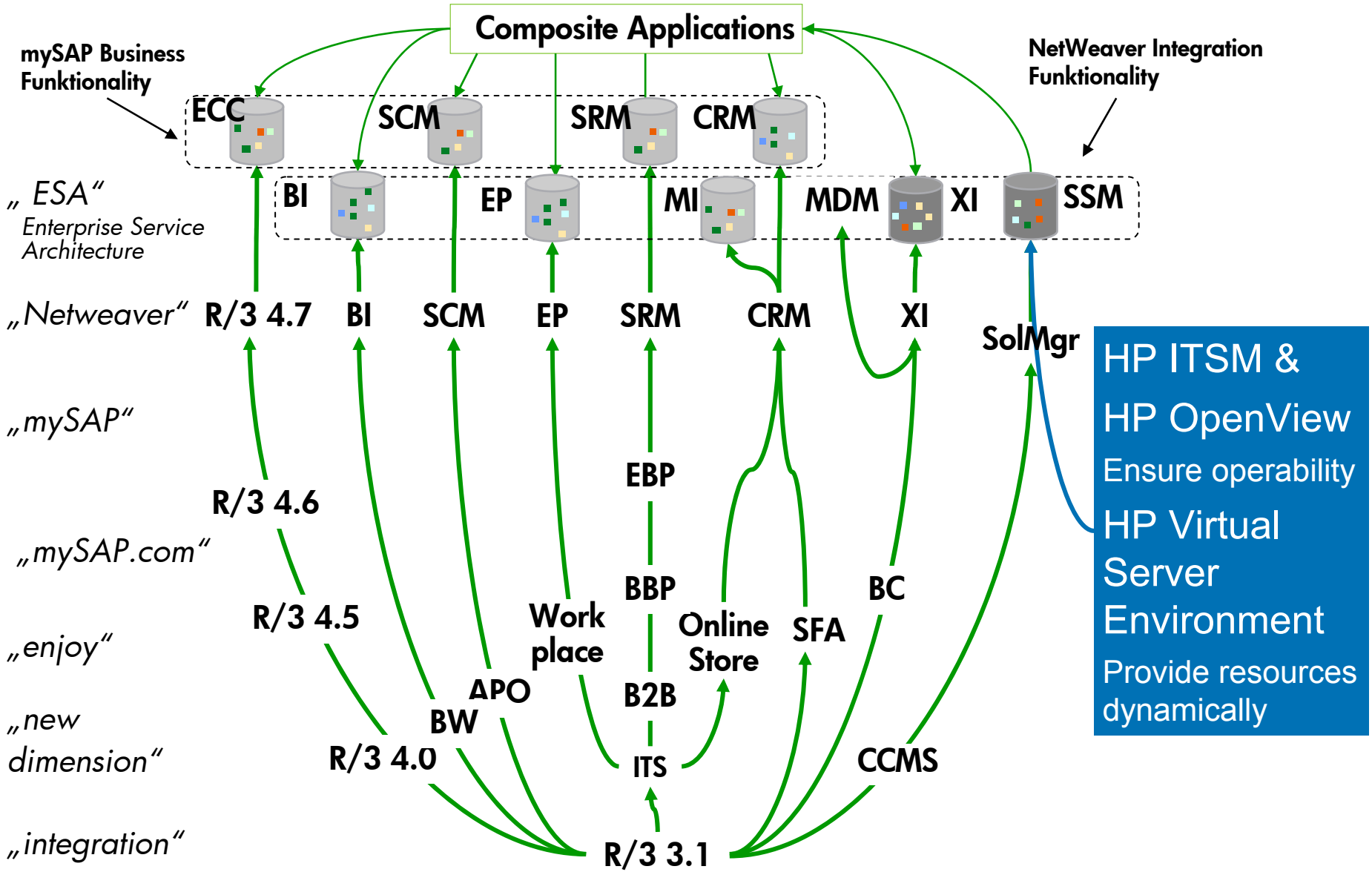
What is a Web-Service?

- Any system that:
 - delivers a specific service as a closed modular functionality
 - can be addressed by Simple Object Access Protocol (SOAP)
 - Where the functionality and the interfaces are described in Web Service Description Language (WSDL)

 is a Web-Service
- This way **any software** in any programming language **can become a Web-Service** – from legacy Mainframe Cobol applications to Java gimmicks **– as long somebody still knows what this software is doing**
- **Summary: a web service is a functionality you can search for**

From R/3 to Enterprise Service Architecture

Decoupling of process and functionality



mySAP infrastructure requirements



© 2005 Hewlett-Packard
The information contained herein is subject to change without notice

64-Bit Platform become mandatory for

- Unicode
- Complex Batch Jobs
 - End of month run's, replenishment etc.
- High User Levels
 - > 1,000 Concurrent Users (medium -> heavy)
- Business Warehouse / SEM
 - Large 16-Way Table Joins, >200Gb Data
- memory resident databases
 - APO LiveCache
 - High performance Analytics

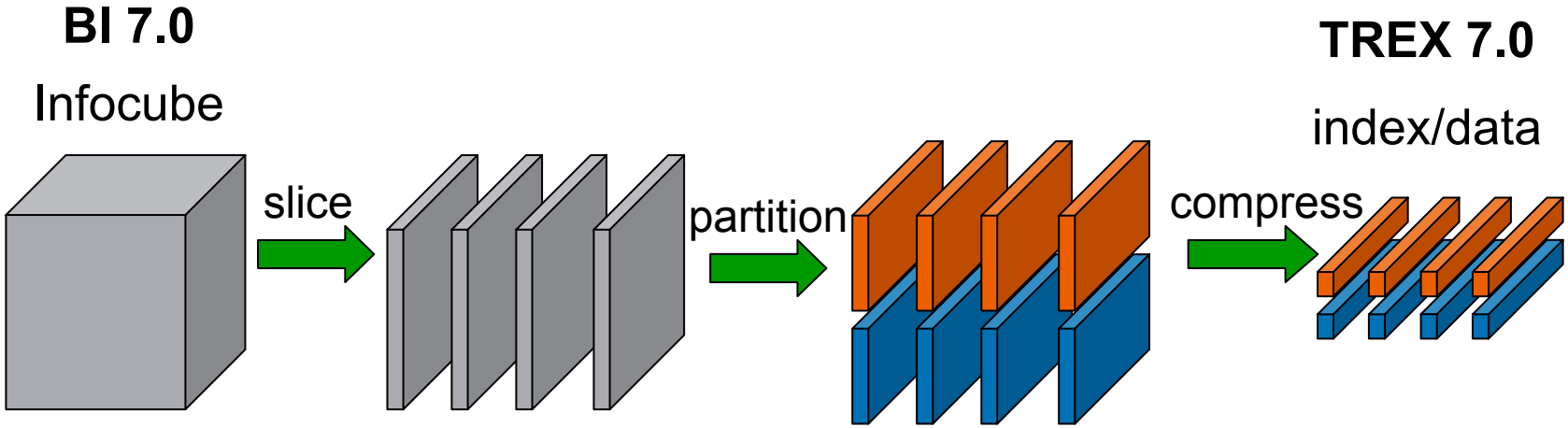
SAP Business Intelligence Accelerator



a joint development of SAP, Intel & HP

SAP Business Intelligence Accelerator

a joint development of SAP, Intel & HP



☺ **Extreme low response times (**HP run‘s reports from info cubes containing 1 billion records within 1/2 seconds)

- compressed “Data-slices” extracted from BI Infocubes
- TREX used to index and find data
- 64-bit servers enables data and indices ton be stored in memory

64 bit Addressing

Goal

- Leverage new features of emerging hardware / operating systems for solutions
- Example: Leverage performance benefits of large main memory and 64 bit addressing

Strategy

- Provide abstraction layer via SAP Web Application Server
- Work with hardware and OS partners to provide 64 bit support for all infrastructure combinations
- Leverage 64 bit address spaces for all SAP NetWeaver components and services as appropriate

Status

- 64 bit support has become mainstream for all Unix system some time ago
- 64 bit support now available for all operating systems (including Windows and Linux)
- 64 bit support for Java becoming available with JDK 1.4.x
- New 64 bit chips (AMD Opteron, Intel Nocona) rapidly replacing 32 bit chips

© SAP AG 2004, SAP TechEd / CI101 / 14

HP Itanium for SAP



hp

HP Integrity at European customers

HP-UX

Ministry of DEFENCE

Government applications

Migros

SAP

AIRBUS

SAP

Why HP Integrity?

- Performance
- RoIT & Scalability

Windows

Deutsche Post World Net

MAIL EXPRESS LOGISTICS FINANCE

SAP

VTG-LEHNKERING AG

SAP

DenizBank

"Bankacılığın yeni rotası"

core & internet banking

- Scaling up Windows
- Price/performance
- Performance

Linux

ADMA OPCO

Oil & Gas exploration

Rohwedder

SAP

bp

SAP

- Performance
- Scalability
- Flexibility

Multi OSs

POLIZEI Niedersachsen

Mission critical applications

FERRERO

SAP



bank-verlag köln

s Service-Unternehmen der privaten Banken

Non-stop

Financial services

- Performance
- RoIT
- Multi-OS Capable

SAP & Itanium

SAP will provide EPIC mySAP components for

- **64-bit Windows**
- **64-bit Linux**
- **64-bit HP-UX**

Currently SAP deploys internally already more than 60 Itanium systems

SAP will support Hewlett-Packard's new combination of IA64 chip technology with the HP-UX operating system. This support will be equivalent to the level of support SAP currently offers for the UNIX landscape.
This support protects the investments of the SAP-HP customer base and is consistent with SAP's efforts to consolidate the number of OS/Chip combinations for mySAP.com.
SAP values the HP partnership and wants to align its development strategies with HP's long-term strategy to convert to IA64 technology.
Walldorf, February 2001

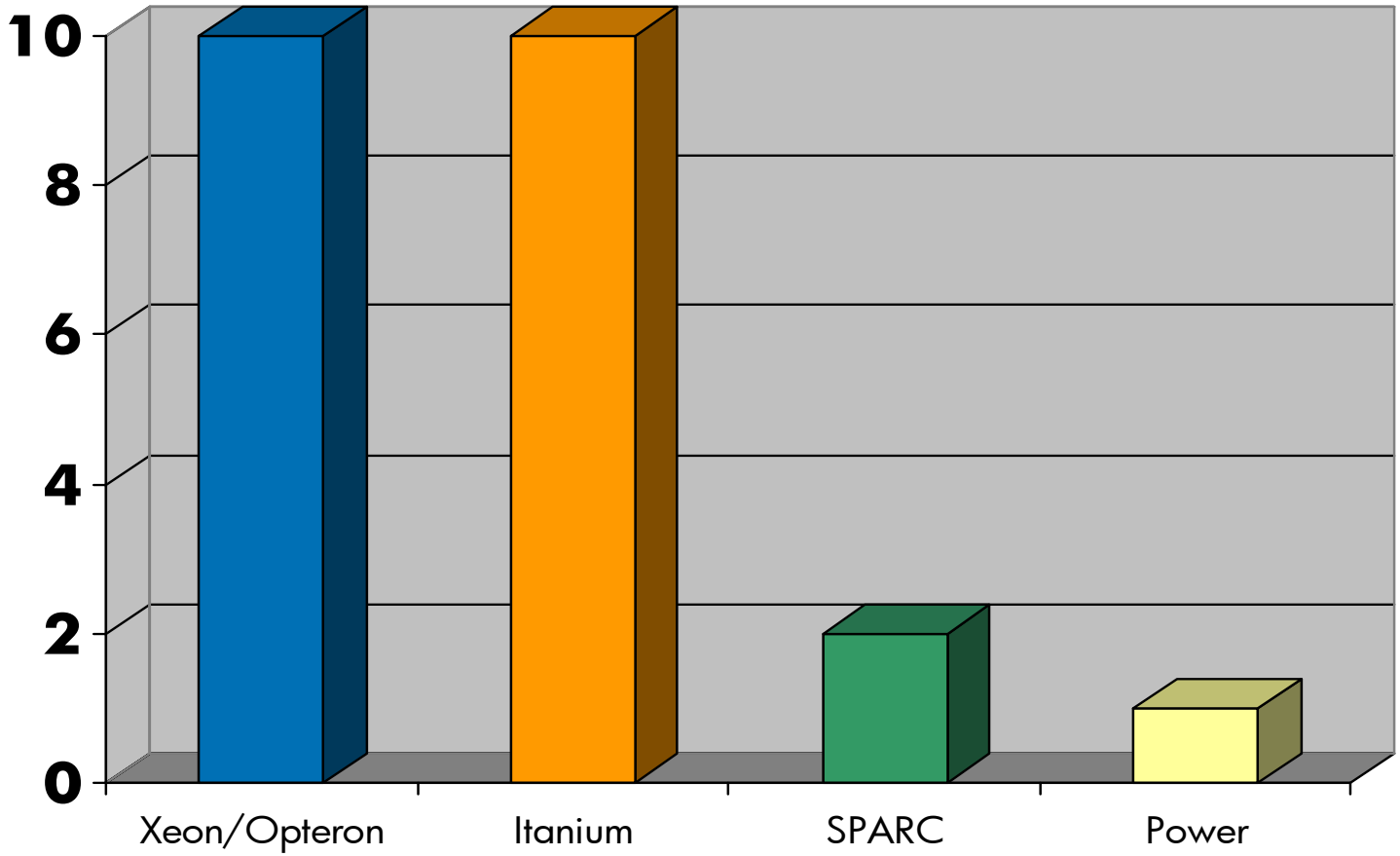
Karl-Heinz Hess
Stephan Rossius

Vendors who benchmarked Itanium systems for SAP

Quelle: www.sap.com/benchmark/sd2tier 31.05.2005

Bull	Windows, Linux
Dell	Windows
Fujitsu-Siemens	Windows
HCL	Windows
Hitachi	Windows
Hewlett-Packard	Windows, Linux*, HP-UX
IBM	Windows
Langchao	Windows
NEC	Windows, HP-UX
Unisys	Windows

Number of Vendors per Platform
(release v4.6 or v4.7)



Quelle: www.sap.com/benchmark/sd2tier 31.05.2005

Transition to Itanium

(for Oracle, MSSQL, DB2 & maxDB)

- from PA-RISC
 - **no export and import required – just reboot**
- from a 32-Bit System Linux
 - **no export and import required – just reboot**
- from a 32-Bit System Windows
 - **no export and import required – just reboot**
- from tru64, AIX, Solaris, Informix
 - **HP and Oracle developed a 5 to 10-times faster technology than SAP standard (200 GB/h instead of 20 GB/h)**

HP Smooth Transition Method

- Reducing downtime by a factor of 5 - 10
 - 100 GB/h instead of 20 GB/h
 - Including index rebuild and transfer of statistics
- High degree of automation & resilience
 - Risc mitigation
 - Reducing consulting effort
 - Reducing complexity
- DB reorganization inclusive (reduces DB size significantly)
- Support via **HP, Oracle**
- No migration key necessary
- **SAP will support the migrated system**

.... what about Opteron?



hp

Current status of Opteron & Xeon64T in SAP environments

- ☺ 32-bit software runs without any changes
- ☺ 64-bit SAP components available on Linux64T (since 3 weeks)
- ☺ 64-bit SAP ABAP components available on Windows64T (no Java)

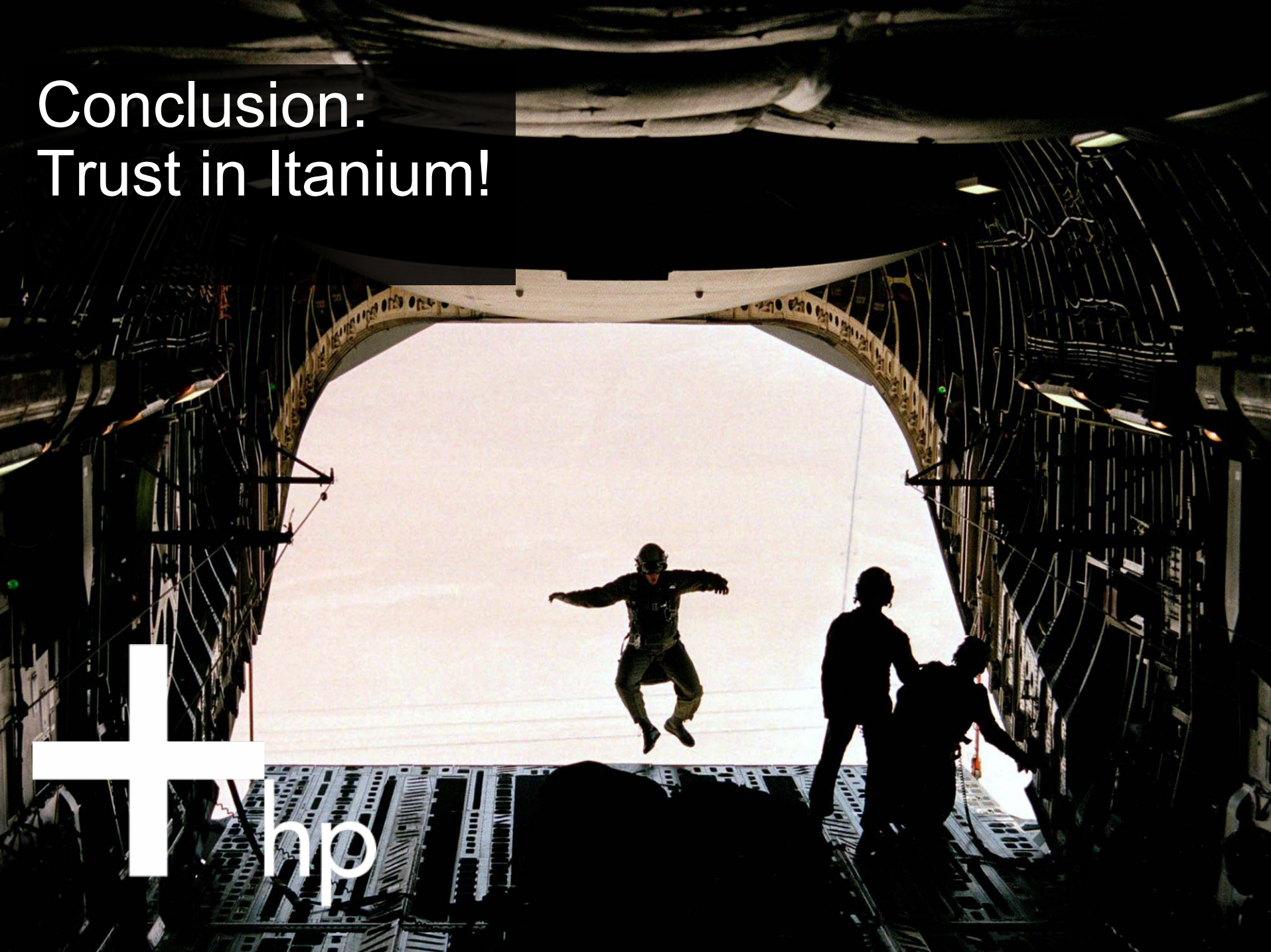
- ☹ Currently no 64-bit SAP Java components available on Windows64T
- ☹ Currently no 64-bit Database available on Windows64T (Microsoft SQL Server and Oracle 10g expected 2006)
- ☹ Still small memory page sizes (4 KB and 2 MB as in IA-32) – applications like SAP liveCache needs larger memory segments
- ☹ Opteron and Xeon64T have to build an ecosystem: OSes, drivers, Databases, Applications. They are where Itanium was 4 years ago
- ☹ Opteron and Xeon64T are missing Reliability features needed in mission critical environment

System Reliability Architecture

Capability	Itanium® 2	Xeon™ MP	Xeon	Opteron
Memory SDEC	✓	✓	✓	✓
Memory spares	✓	✓	✓	
Lockstep support	✓	✓		
Partitioning	✓	✓		
Electrical isolated partitions	✓	✓		
Error recovery on data bus (ECC)	✓			
Bad data containment	✓			
Internal soft error logic check	Montecito			
Cache Reliability (Pellston)	Montecito			

Itanium features reliability functions for mission critical applications, not found in EM64T and Opteron®

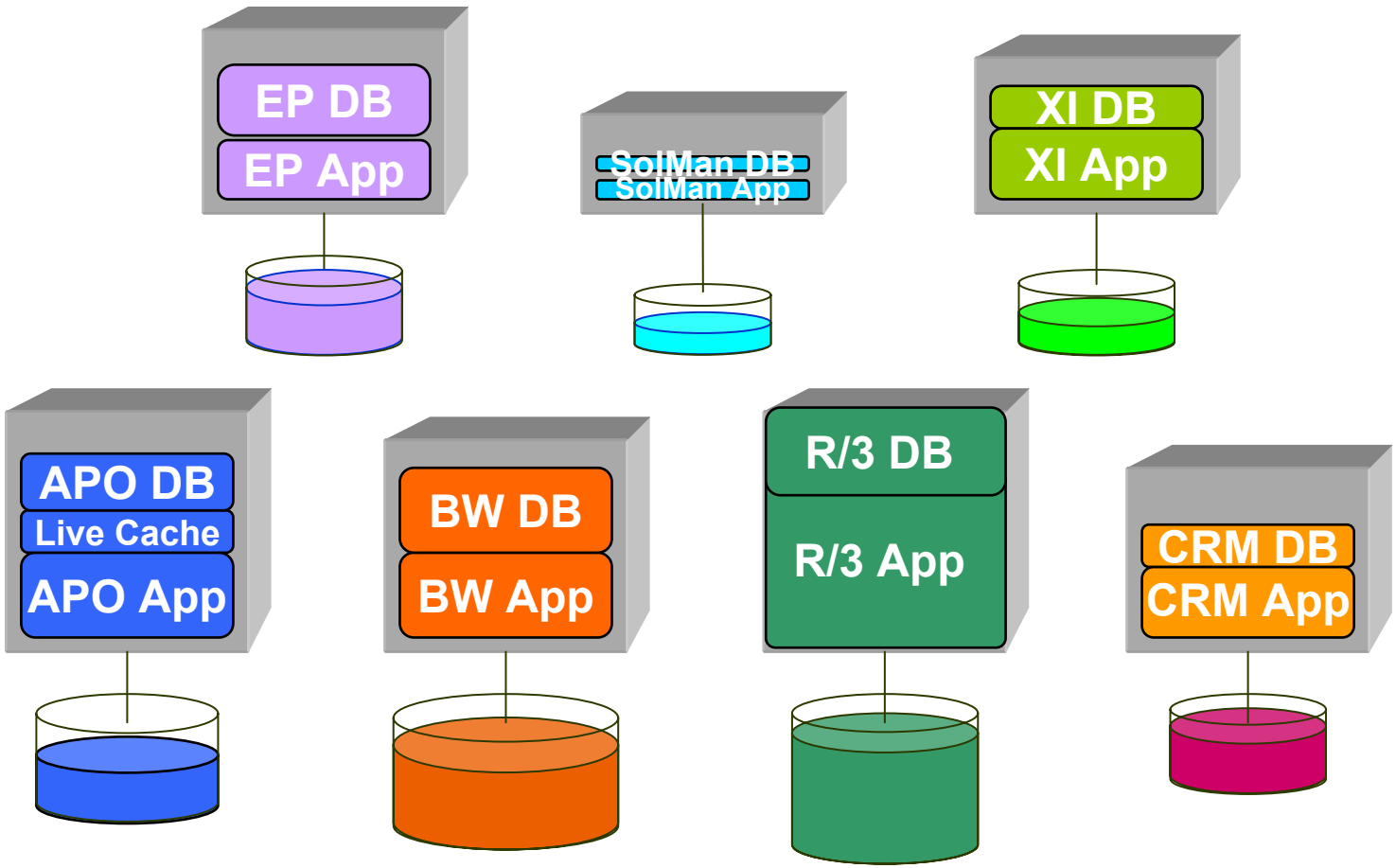
Conclusion:
Trust in Itanium!



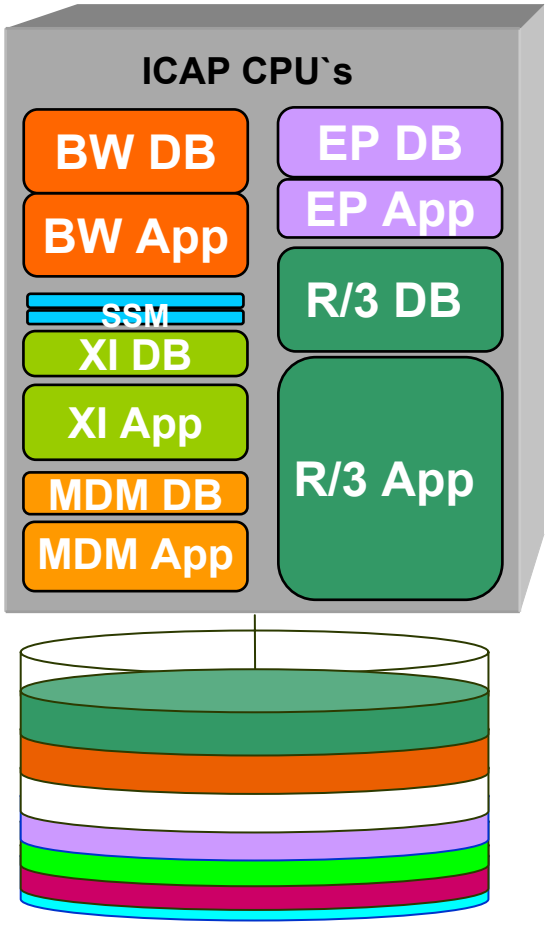
Virtualized Infrastructures for SAP System Landscapes



Typical SAP Landscapes



consolidated NetWeaver Landscape



Maximized Flexibility

Minimized TCO

Possible with every database
(besides DB2)

MORE performance by

- Ideal load distribution DB-APP
- Avoid latency and interrupts

Better utilization of system resources (Economics of scale)

- Leveraging “user peaks”
 - Better Buffer and Cache Utilization

LESS operation **effort**

LESS maintenance **fees**

Maximum flexibility at peak loads

Optimal utilization of system resources

- Leveraging “application peaks”
- no round up syndrome

The rounding-up syndrome

Sizing example for a mySAP Landscape:

R/3:	8.1 CPU	rounded up to 9 CPU
BW:	5.2 CPU	rounded up to 6 CPU
APO:	4.4 CPU	rounded up to 5 CPU
CRM:	0.6 CPU	rounded up to 2 CPU
SRM:	0.4 CPU	rounded up to 2 CPU
EP:	2.1 CPU	rounded up to 3 CPU
XI:	2.2 CPU	rounded up to 3 CPU
Total:	23 CPU	30 CPU

Virtualization: Run many SAP services on few operating systems!

- Applications work directly on the operating system, no loss of resources through abstraction layers
- Preemptive multitasking takes care of fair share resource assignment
- SAP services are astonishingly well behaved in terms of resource usage
 - CPU usage may vary
 - Memory usage is pretty much fixed through SAP parameters, cannot be changed without restart of SAP service
- Many customers use this model successfully without any problems since more than 6 years already

It‘s like room sharing: it is ok as long as your room mate doesn‘t snore and gives you a fair share of the blanket.

Consolidation: the two big concerns

1. **Resource Isolation**
 - How can I be sure that performance issues in one SAP system does not hurt the others?
2. **Security isolation**
 - How can I be sure that users on one SAP system have access to information's on other SAP systems?

The misunderstandings on partitions



When somebody gets
a new hammer,
suddenly every problem
looks like a nail

- **Partitioning is: “combining maximum of flexibility with necessary isolation”**
- **Partitioning is NOT: “buy a big box and cut it down into smaller boxes”**

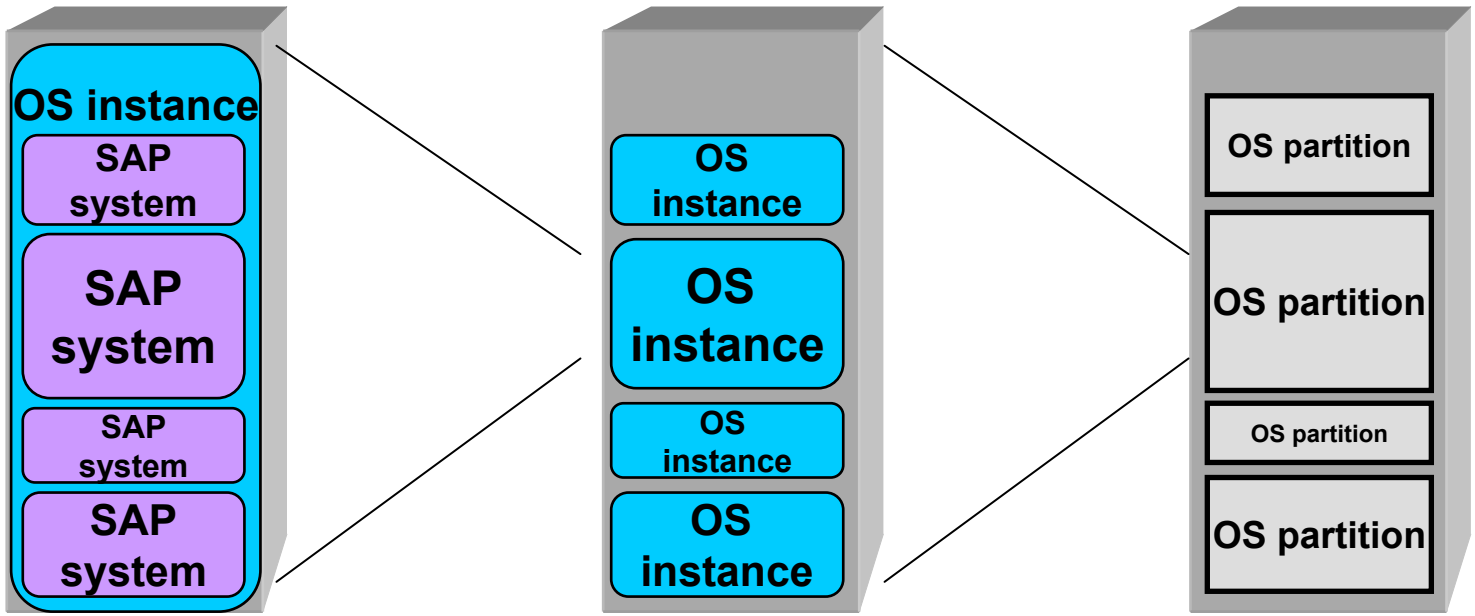
HP virtual server environment (VSE)

flexible partitioning options enables mySAP consolidation

Resource Partitions* within Virtual Partition (per %)

Virtual Partitions within a hard partition (per CPU)

Hard Partitions (per cell board)



Process Resource Mgr. Workload Manager

HP Virtual partitions

HP Superdome technology

Best resource usage ⟷ **Best isolation**

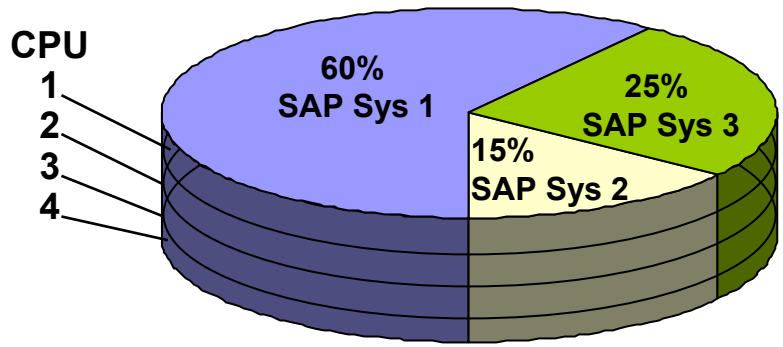
***Possible with all databases besides DB2**

VSE Process resource partitioning

HP Resource Manager

grant multiple SAP Systems random percentage of total available CPU power

- ☺ Hard limits: use granted % CPU resource
- ☺ Soft limits: use any unused CPU resource (as long as no other app needs his %)
- ☺ Transparent to application (extended OS scheduler)



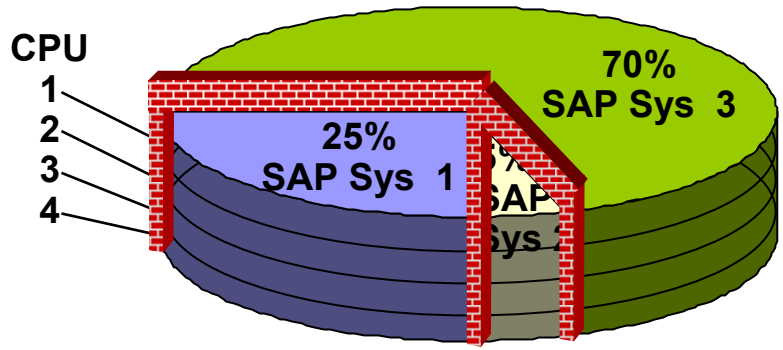
Adapt resource distribution dynamically according to SLA settings (without reboot)

VSE Process resource partitioning

HP Resource Manager

grant multiple SAP Systems random percentage of total available CPU power

- ☺ Hard limits: use granted % CPU resource
- ☺ Soft limits: use any unused CPU resource (as long as no other app needs his %)
- ☺ Transparent to application (extended OS scheduler)



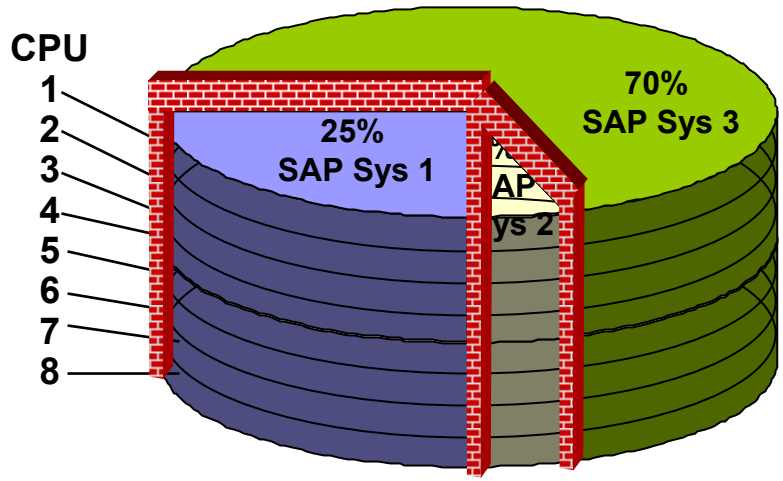
Security Containments change also dynamically

Adapt resource distribution dynamically according to SLA settings (without reboot)

VSE Instant Capacity

Add and remove CPU dynamically (without reboot)

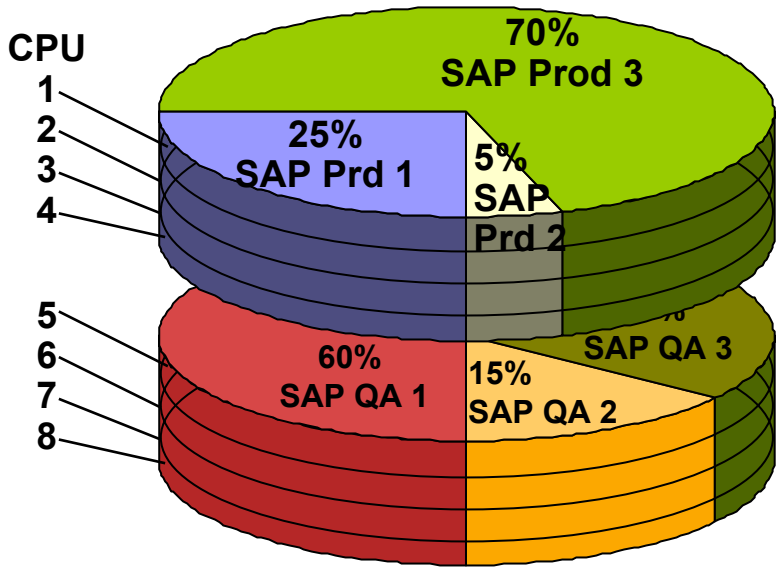
- **Instant Capacity (ICAP)**
 dynamic activation of additional CPU's on demand
- **temporary Capacity (tICAP)**
 dynamic activation & de-activation of additional CPU's on demand (even single cores on dual core chips)



Dynamic alignment of TCO to consumption of IT resources used by business processes

VSE Virtual Partitions

- Multiple HP-UX releases
- Multiple HP-UX patch levels
- Multiple SAPOSCOL
- Application and OS fault isolation
- Individual reconfiguration and reboot, e.g. for rolling upgrades

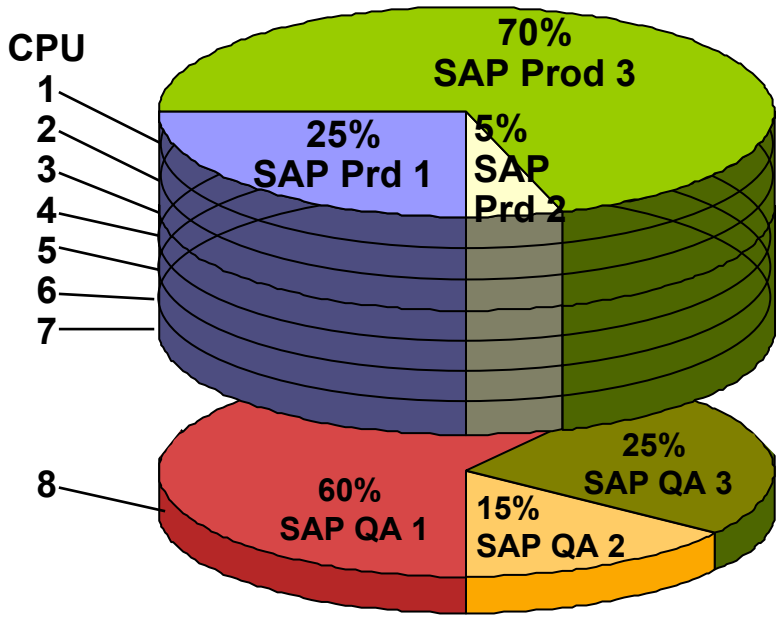


single CPU granularity

Enables consolidation of productive and non-productive systems on same hardware

VSE Virtual Partitions

- Multiple HP-UX releases
- Multiple HP-UX patch levels
- Multiple SAPOSCOL
- Application and OS fault isolation
- Individual reconfiguration and reboot, e.g. for rolling upgrades

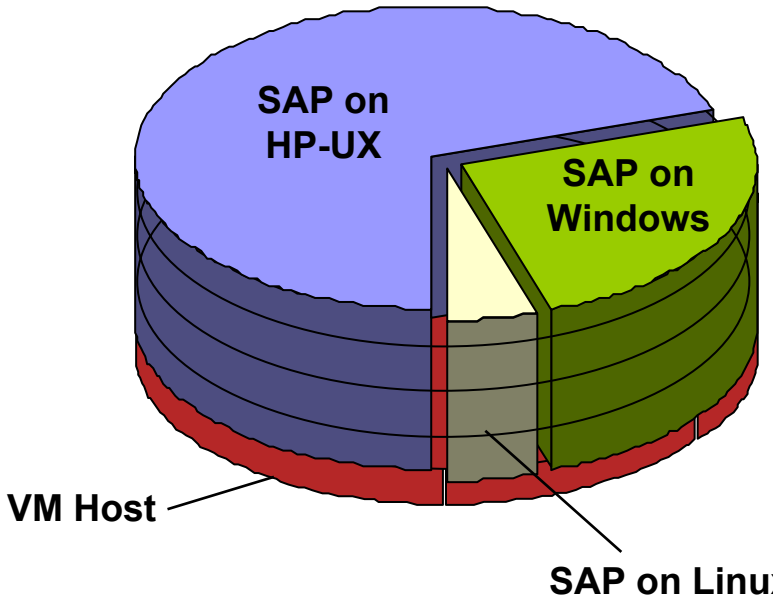


dynamic reassignment of CPUs across virtual partitions

Enables consolidation of productive and non-productive systems on same hardware

VSE Virtual Machines

- ☺ different OS patch levels
- ☺ distinct SAPOSCOL per OS
- ☺ Fine granularity (min 5%)
- ☺ From 1 to 4 (later 128) CPU
- ☺ Application and OS fault isolation
- ☺ Individual reconfiguration and reboot



sub CPU granularity
Up to 20 guest OS

Enables consolidation of Multiple Operation Systems on one hardware (HP-UX, Linux, later Windows)

SAP support for Virtual Machines

- HP-UX:
 - Does not need to be certified for HP-UX by SAP, SAP only certifies the operating system with UNIX
 - Will be thoroughly tested between HP and SAP engineering, please wait for completion of these tests before using them producitvely
- Linux: will have to be certified
- Windows: situation still unclear regarding certification, licensing etc.

What about micro partitions?

- ☹ **IBM Intelligent Hypervisor needs two dedicated CPUs** those CPUs cannot do any application work.
- ☹ **IBM Intelligent Hypervisor cause 15% - 40% overhead!**

 according to ITG whitepaper “Cost/Benefit Case for Micro-Partitioning”
- ☹ **IBM Intelligent Hypervisor provide Sub-CPU partitioning only**

 i.e. 0.1 CPU but no 1.9
- ☹ **IBM DB2 can’t be stacked (i.e. need a dedicated OS instance)**
- ☺ **HP Virtual Machine can span multiple CPU (from 0.05 to 4)**
- ☺ **HP Virtual Machine need no dedicated CPU,** all CPU power of the machine can be used by applications if the virtualization layer has nothing to do
- ☺ **HP Virtual Machine will support Serviceguard Cluster**
- ☺ **HP provide Secure resource partitions**
- ☺ **Multi OS management with provisioning**
- ☺ **Integrated Utility Pricing with virtualization**

Golden rules for SAP System consolidation

for optimum resource usage and flexibility

- run database and application together as a central system
- run multiple SAP systems on one OS instance (Appl. stacking)
- for mix of production and non-production SAP systems or non SAP applications use v-par, n-par or Integrity VM

for resource isolation

- use Process Resource and Workload Management

for high security levels

- deploy Security Containment

Be aware:

- only CPU and I/O can be managed dynamic in SAP, to change the Memory share the SAP instances must be rebooted
- There is exactly one SAPOSCOL per OS instance – therefore the resource consumption of stacked SAP systems must be tracked with OS tools

Real live example : Magdeburg SAP University Competence Center

- more than 40.000 Users
- more than 500 Academic institutions connected
- 92 SAP Instances
- Server-Farm with 135 HP Servers and 85 TB storage
- World wide reference for SAP and HP in teaching and research



Practical issues: 1 Server per SAP instance result in:

☹ **Enormous waste of hardware resources**

☹ **High costs and administration effort**

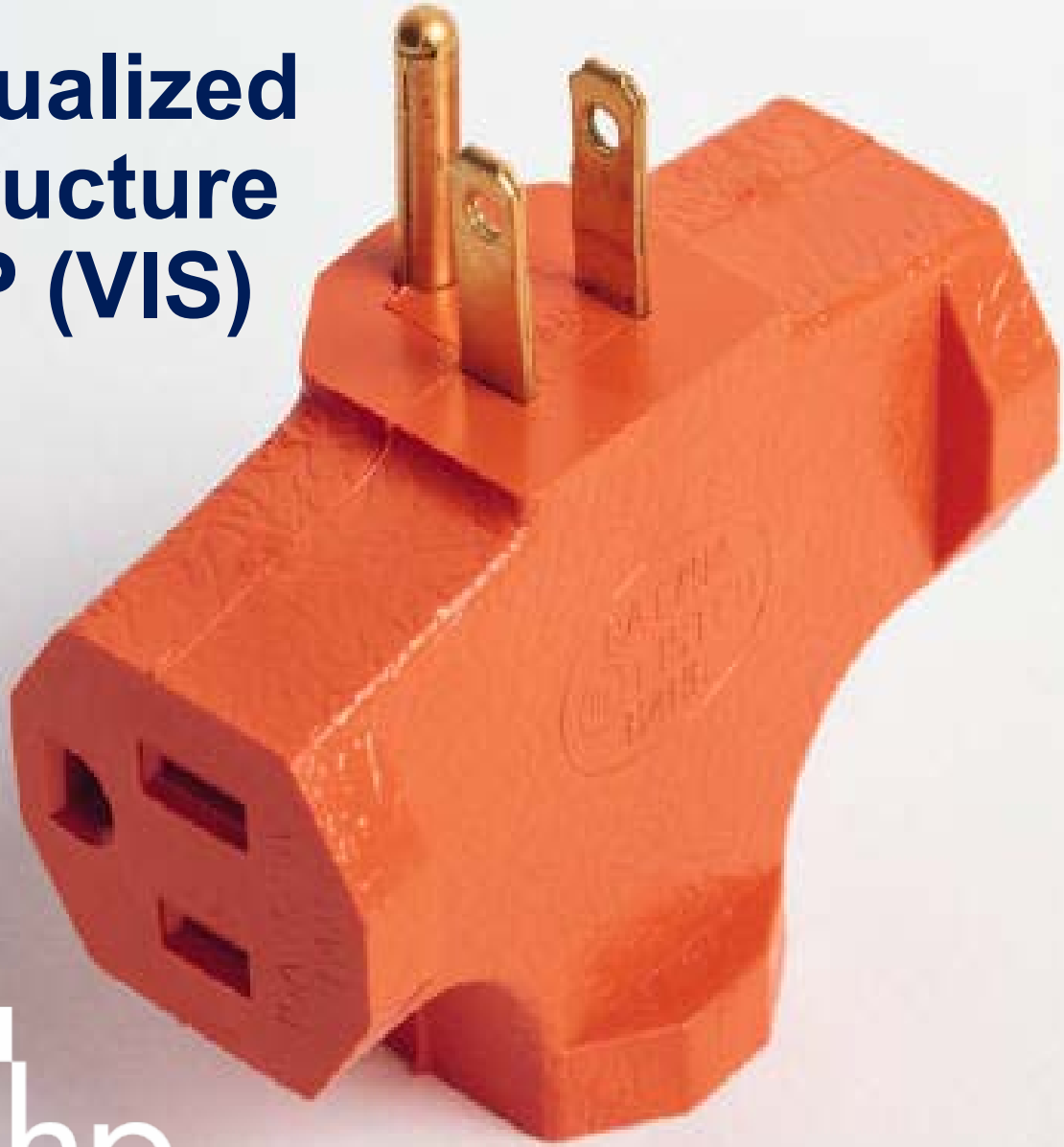
Practical experience with HP VSE

- Consolidation of Systems from 135 to 8
 - Reduction of instances
 - More clients per instance
- Virtualization of Systems
 - No fixed assignment of systems to hardware
 - Workload-based (re-)allocation of SAP systems to hardware resources

Resources can be used more efficiently:

- Less demand on computer centre space
- Less energy consumption – less air condition
- Less administrative costs (6 Admins for > 40.000 Users)
- **Cost savings of 30%** (conservatively calculated)

HP Virtualized Infrastructure for SAP (VIS)



hp

HP‘s Application service control

HP-UX Pool Management Node

- Ignite/UX for O/S deployment
- NFS server for shared files and config
- NIS for central config mgmt
- DHCP server for pool nodes
- Highly availability mandatory

Linux Pool Management Node

- Rapid Deployment Kit for O/S deployment
- NFS server for shared files and config
- NIS for central config mgmt
- DHCP server for pool nodes
- Highly availability mandatory

Windows Pool Management Node

- Rapid Deployment Kit for O/S deployment
- Windows File Shares for shared files and config
- Active Directory / LDAP for central config mgmt
- DHCP server for pool nodes
- Highly availability mandatory

SAP Solution Manager

Adaptive Computing Controller

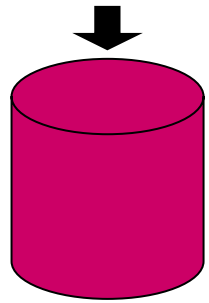


Sapacosprep agent

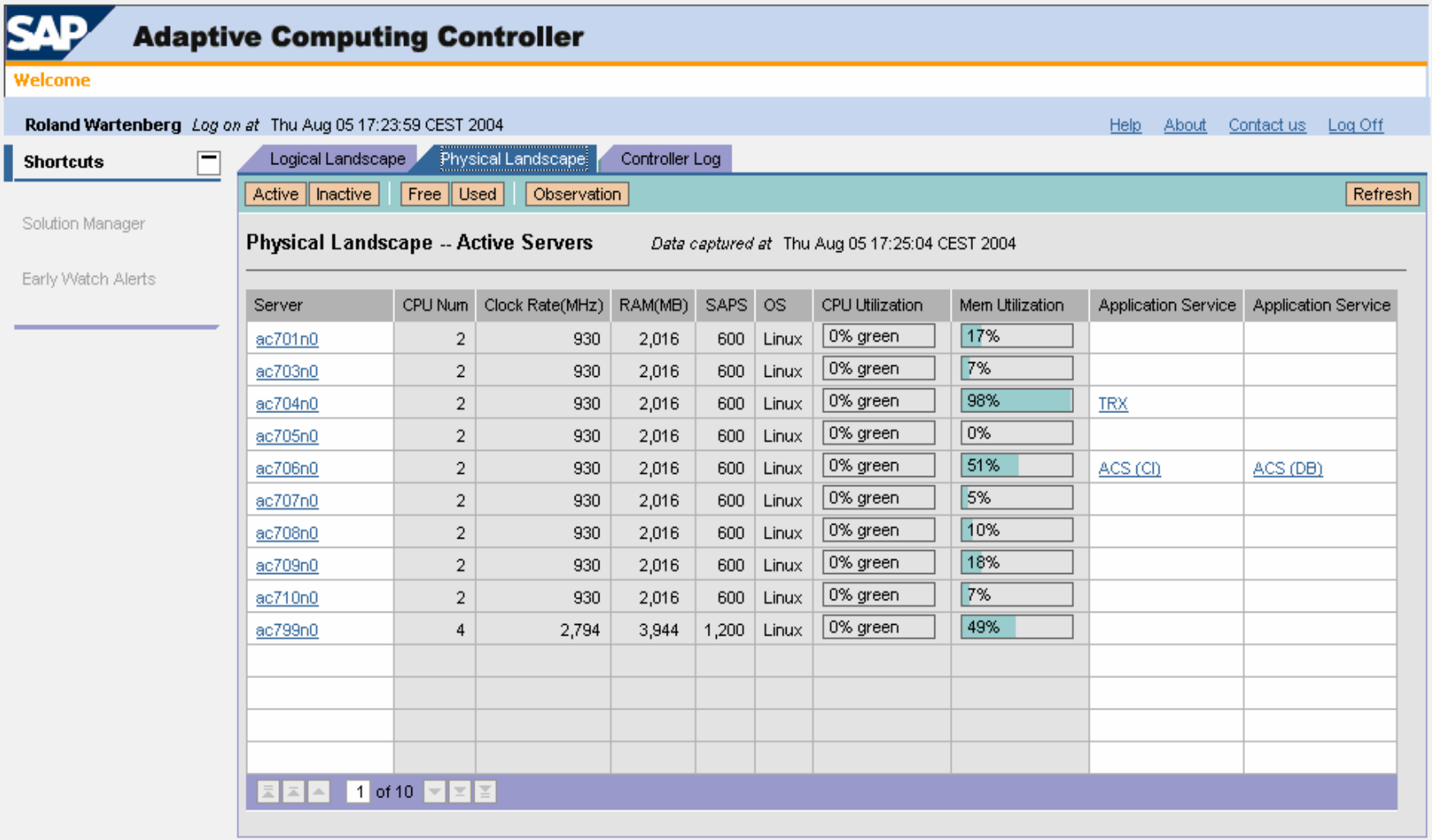
HP Platform specific lib

Adaptive Disk Array Manager

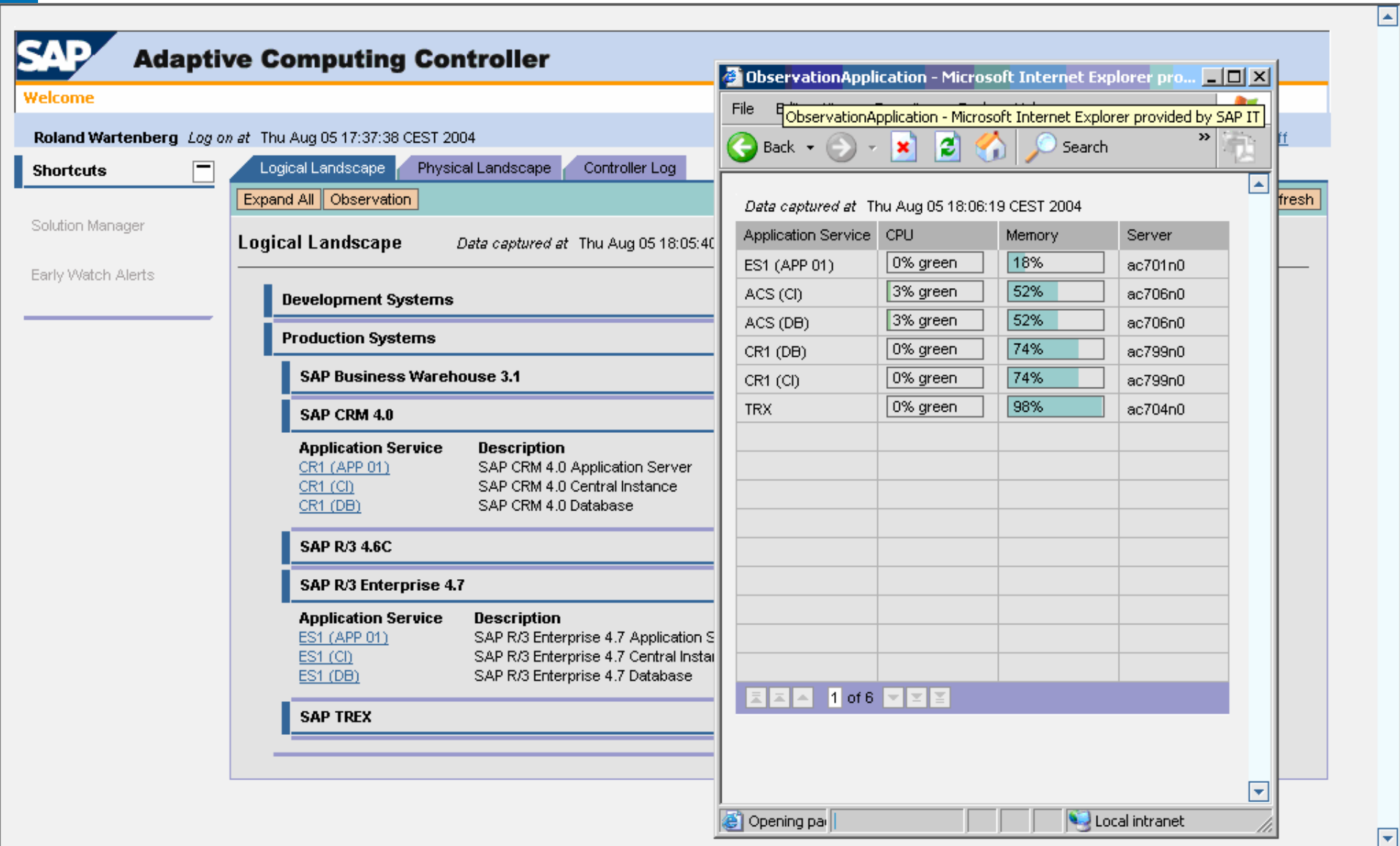
HP ADAM



SAP ACC: Physical landscape view



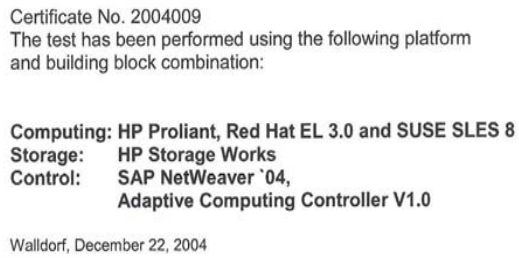
SAP ACC: Logical landscape view



SAP Compliance



- SAP Certificate of Conformity
 - Recognized SAP visual
 - Scenario details
 - Technological engagement with SAP



Certificate No. 2004009
The test has been performed using the following platform and building block combination:

Computing: HP Proliant, Red Hat EL 3.0 and SUSE SLES 8
Storage: HP Storage Works
Control: SAP NetWeaver `04,
Adaptive Computing Controller V1.0

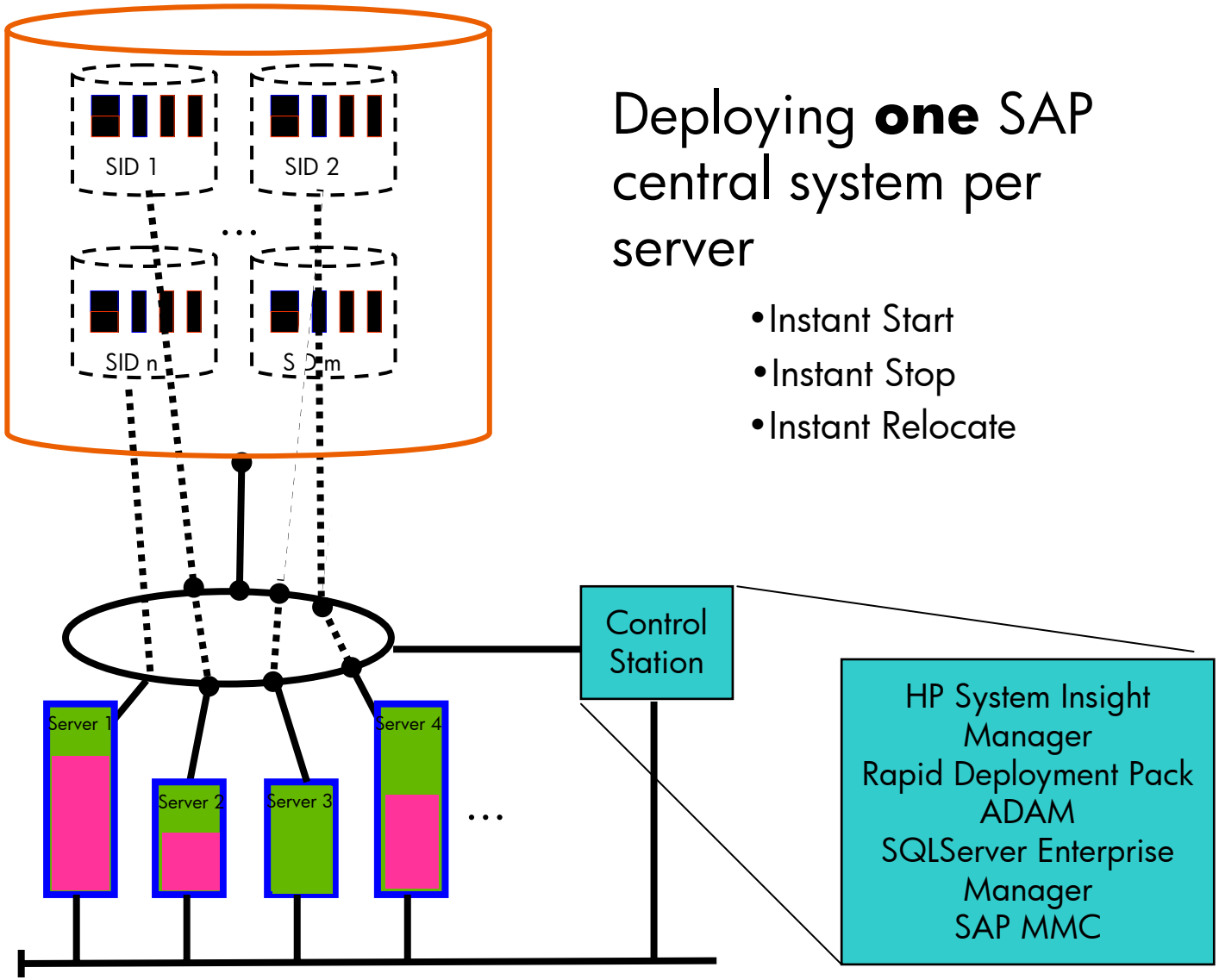
Walldorf, December 22, 2004

Certification for Windows promised to HP – stay tuned and start with our offering

(currently only under NDA)

- Benefits
 - Knowledge Transfer
 - Quality Assurance

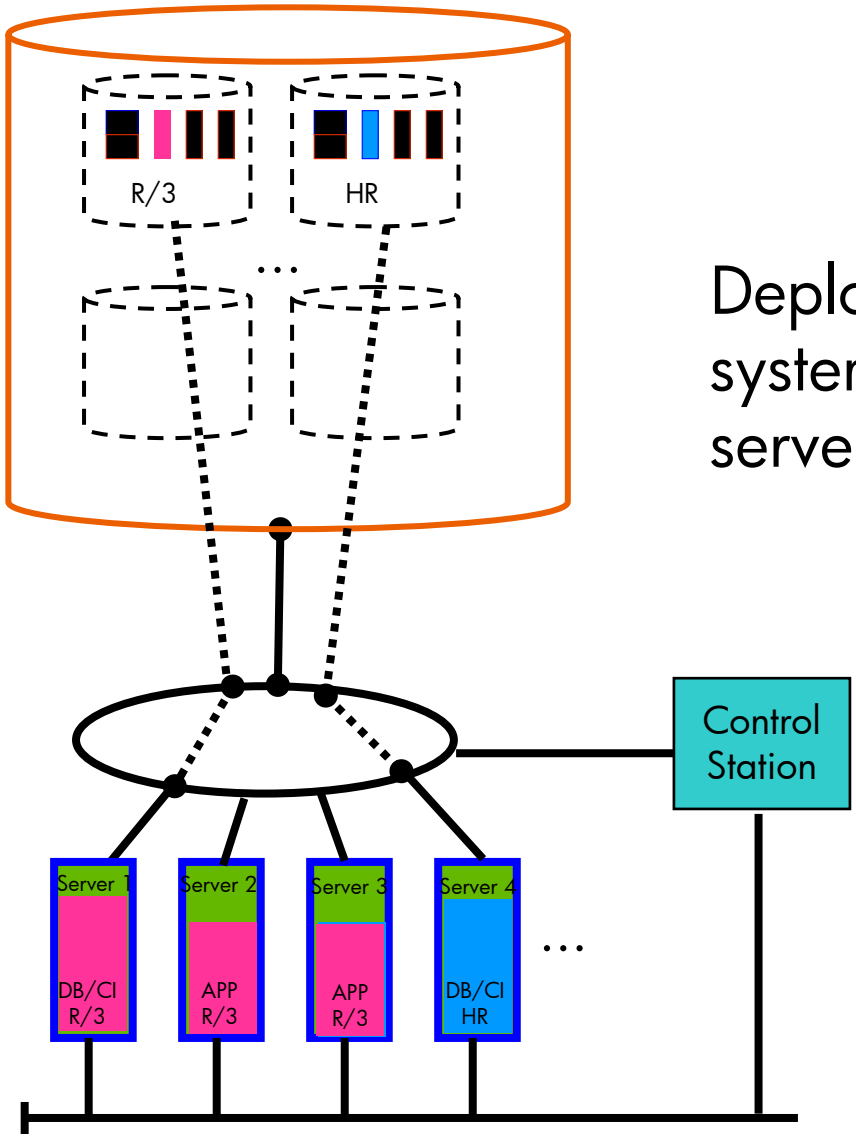
SAP VIS Parking lot concept



Deploying **one** SAP central system per server

- Instant Start
- Instant Stop
- Instant Relocate

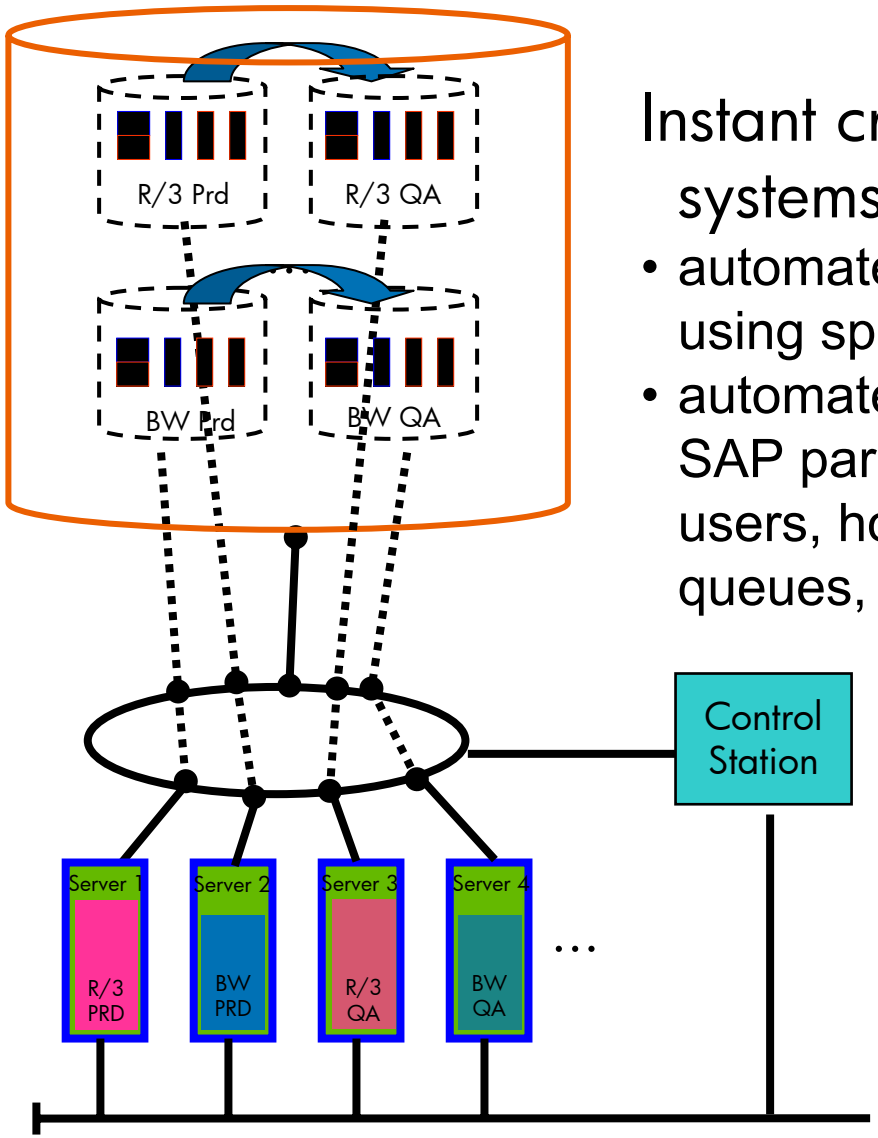
SAP VIS Dynamic workload balancing



Deploying **one** SAP system on **multiple** servers

- Instant stop of dialog instances
- Instant start of dialog instances

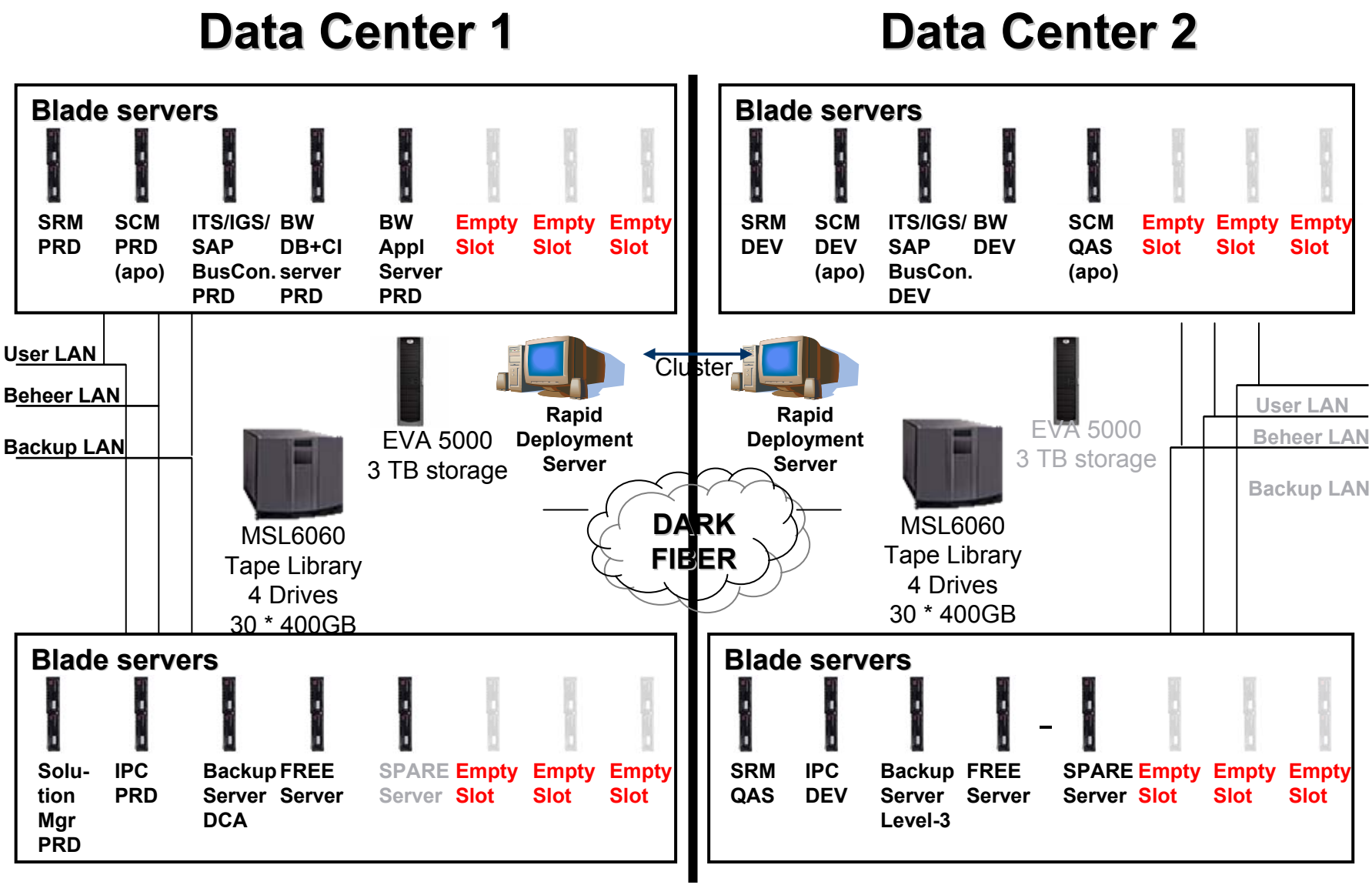
SAP VIS QA System generation



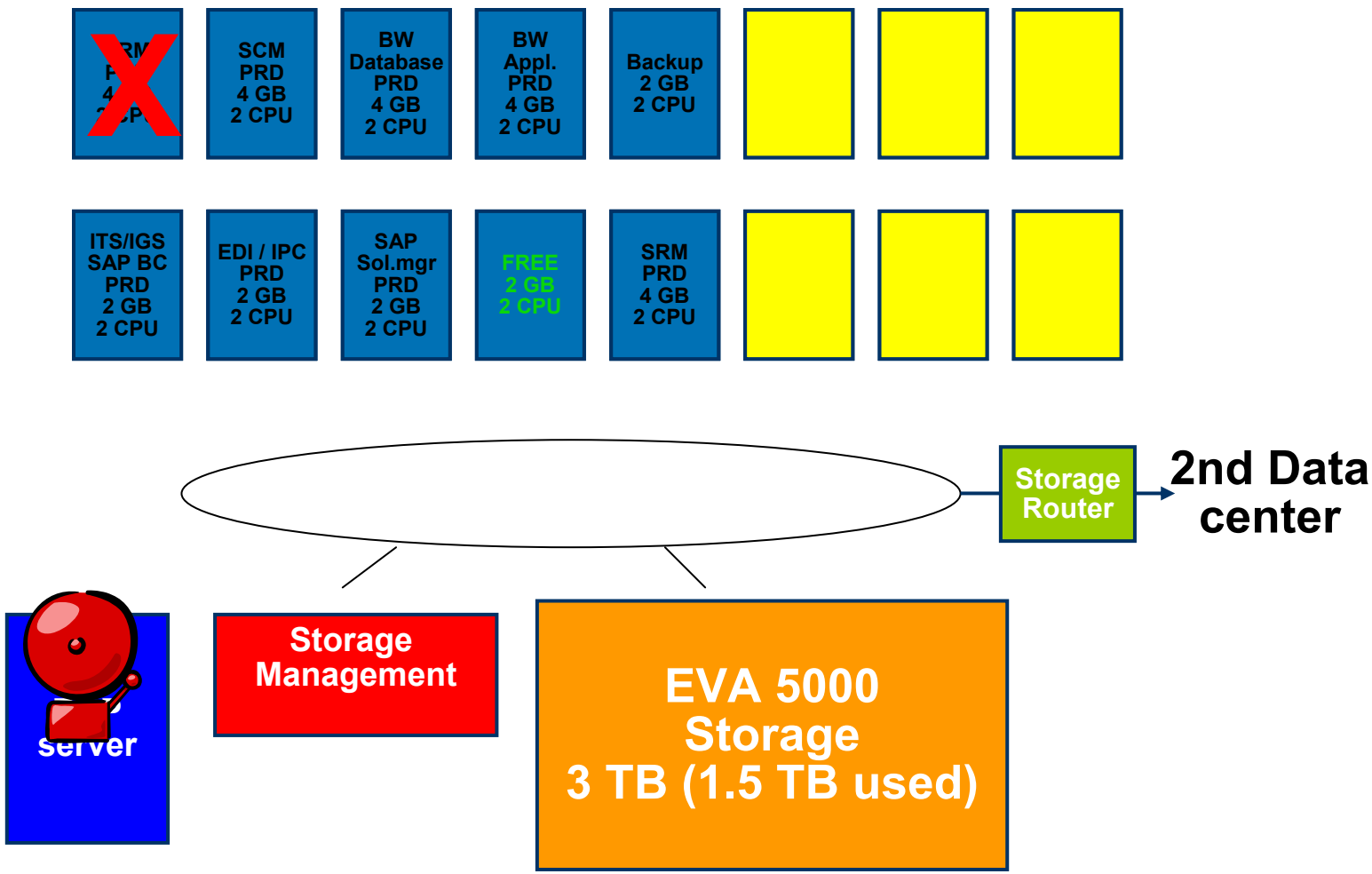
Instant creation of SAP Test systems (or training, Sandbox)

- automated copy production system using split mirror
- automated modification of OS and SAP parameters (sid, services, users, hostname, profiles, output queues, etc.)

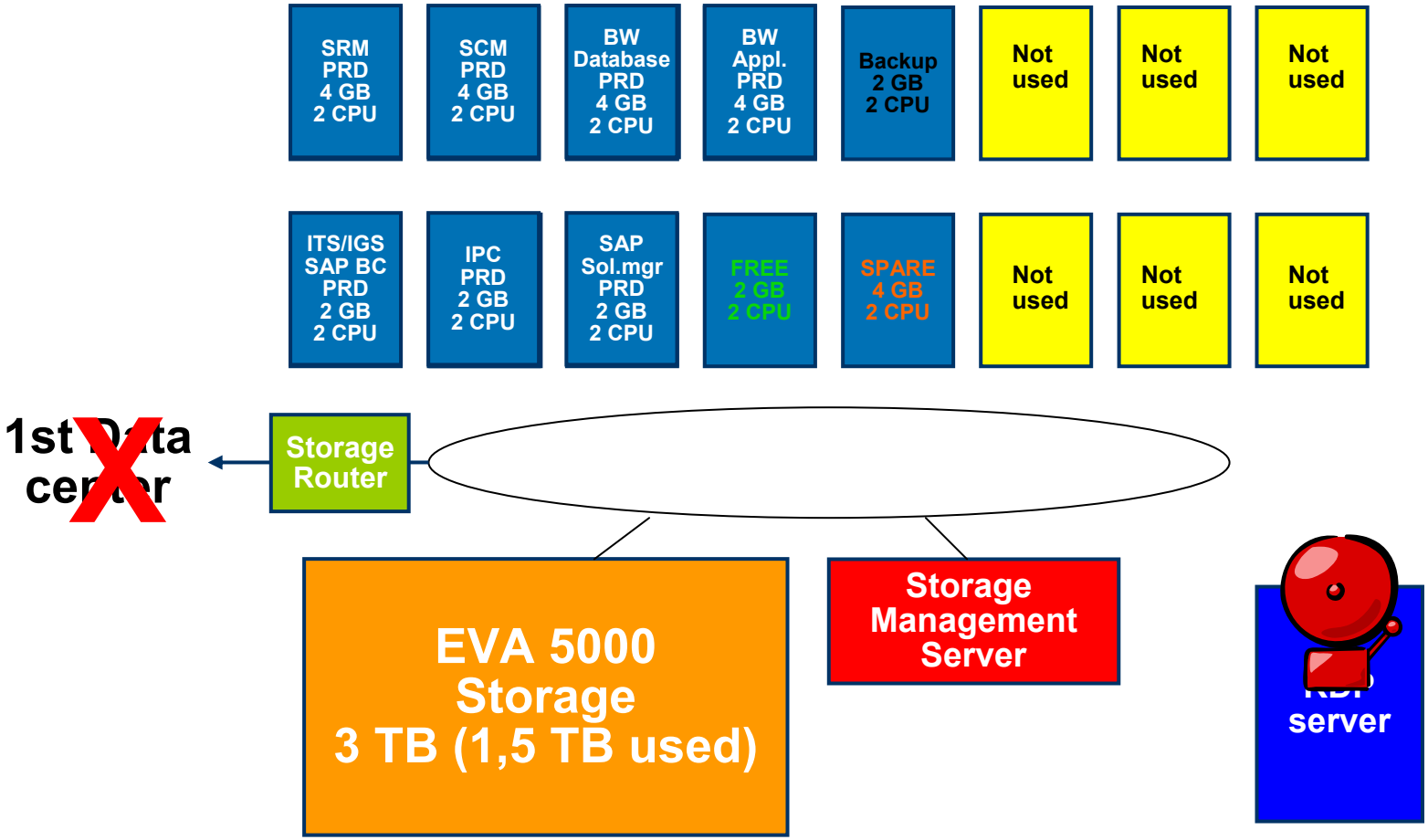
Real live example: pharmaceutical Industry



Manual Failover scenario:
Hardware failure server in DC 1



Manual Failover scenario: Failover to 2nd Data Center



VSE versus VIS - what fits?

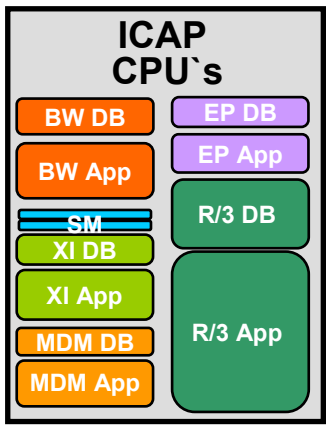


Virtualized Infrastructure for SAP (aka ACC)

- Lowest investment cost

Ideal fit for:

- temporary usage like Test, Training, Sandbox, Evaluation
- Some downtime acceptable
- Manual intervention acceptable



Virtual Server Environment

- Highest flexibility
- Highest utilization
- Lowest operation cost

Ideal fit for:

- Mission critical applications
- Granted service levels (response & Batch runtime time)
- Productive Enterprise Service Architectures (ESA/SOA)

Scale Up versus Scale Out



© 2005 Hewlett-Packard
The information contained herein is subject to change without notice

Scale Up versus Scale Out



?

Scale Up

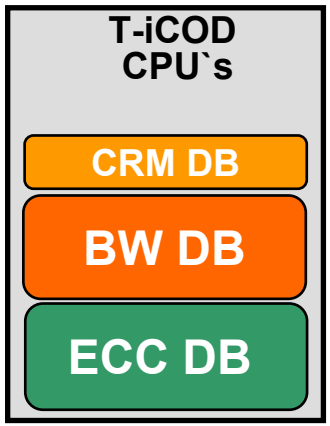
Scale Out



The right approach in the right place



Scale Up versus Scale Out: what adapts?



- Scale Up: Applications remains unchanged, the infrastructure adapts to changing needs of the application:
 - Ressource Management for more / less CPU power
 - Move CPUs between vPARs
 - Turn on/off iCOD CPUs

→ **no disruption of the application**



- Scale Out: Infrastructure remains unchanged, the application adapts according to its changing needs:
 - Start/stop applications on a node
 - Move applications between nodes to get the right load balancing through the right combination of applications on a node
 - Add/remove dialog instances to get more / less power

→ **changes cause reboot of the application**

The “round up syndrome” reloaded

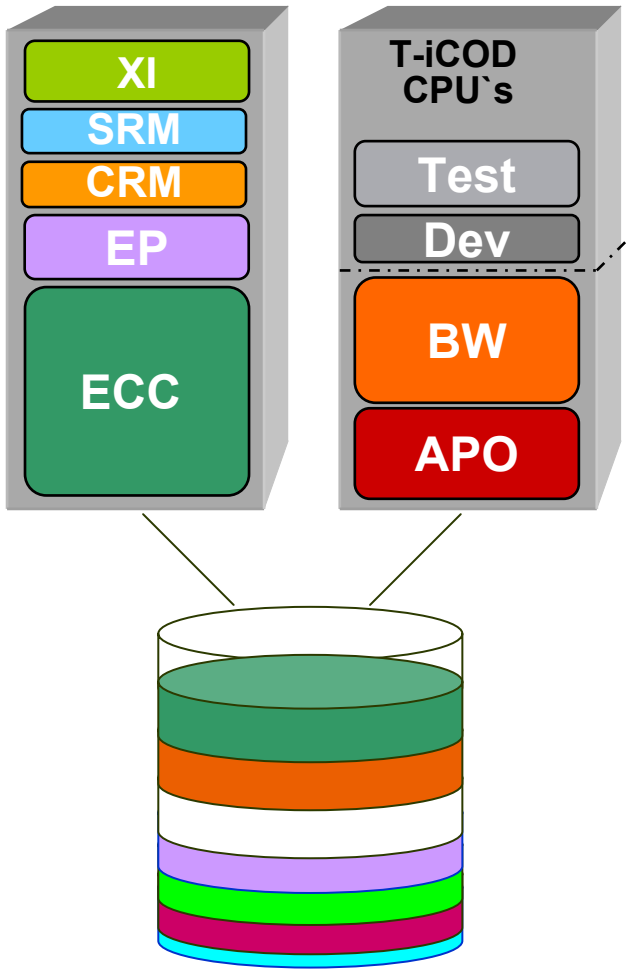
Scale up

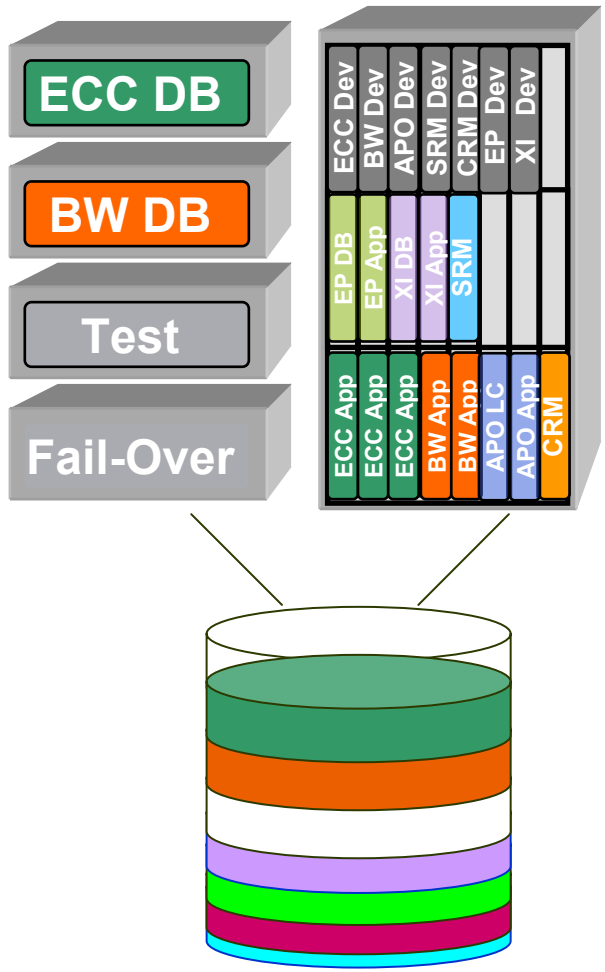
PRD (dedicated)	
ECC:	8.1 CPU
BW:	5.2 CPU
APO:	4.4 CPU
CRM:	0.6 CPU
SRM:	0.4 CPU
EP:	2.1 CPU
XI:	2.2 CPU
Test (shared)	3.4 CPU
Dev (shared)	2.6 CPU
Fail-over	4.0 (T-iCoD)
Total:	2x16 CPU
Mem for OS	3x 0.5 GB

Scale out

PRD (dedicated)	
ECC:	1x4 DB + 3x2 App
BW:	1x4 DB + 2x2 App
APO:	1x2 DB + 2x2 App/LC
CRM:	1x2 DB/App
SRM:	1x2 DB/App
EP:	1x2 DB + 1x2 App
XI:	1x2 DB + 1x2 App
Test (shared)	1x4 DB/App
Dev (shared)	7x2 DB/App
Fail-over	1x4 (in parking lot)
Total:	4x4 + 20x2 CPU
Mem for OS	24x 0.5 GB

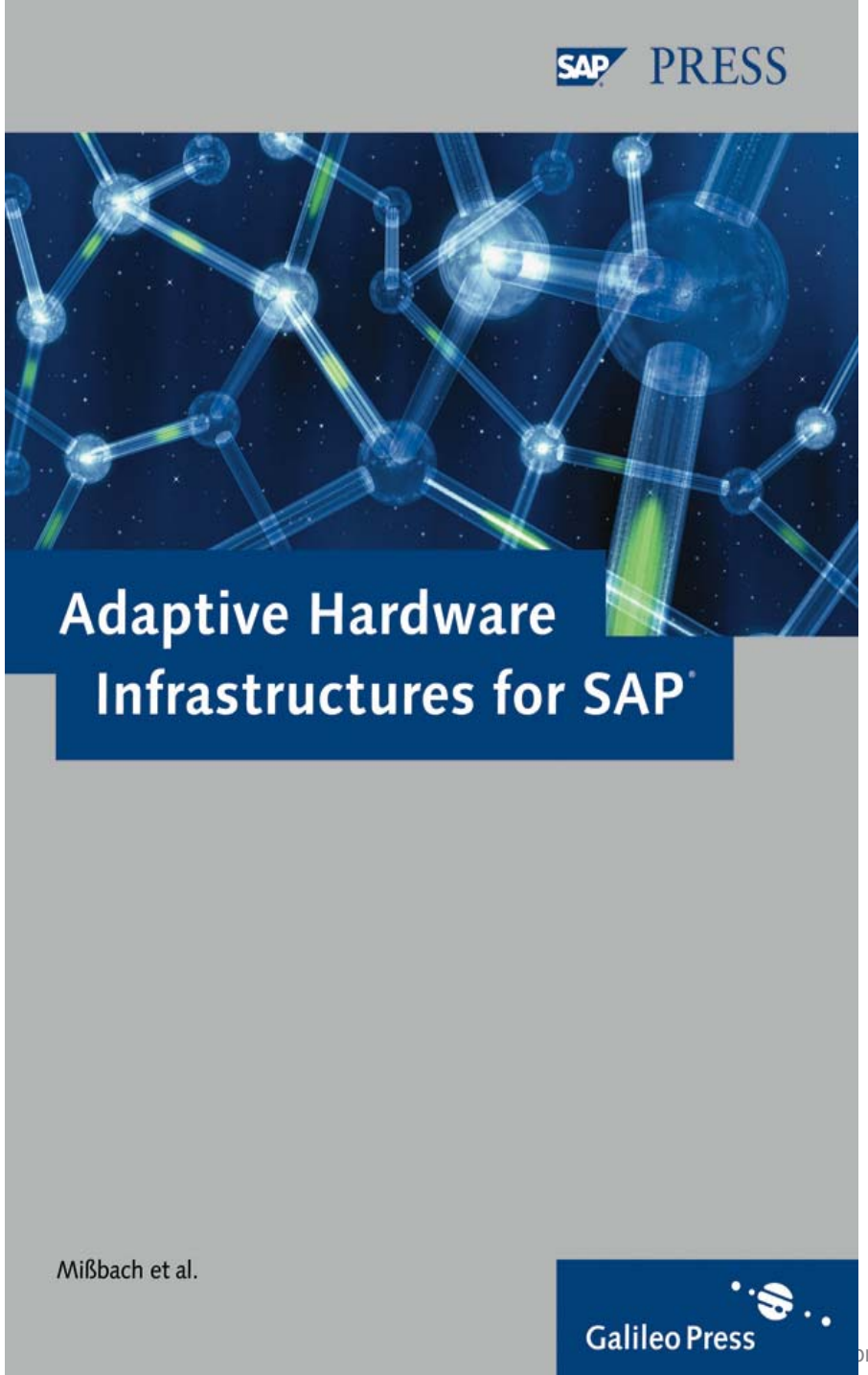
Scale Up versus Scale Out: what fits?





What really count's: TCO

	Scale up	Scale out	
CPU	64 bit	64 bit	32 bit
OS Instanzen	3	4	17
Hardware	2 x 16-CPU	4 x 4 CPU	17 x 2 CPU
Leasing HW p.a.	193.333 €	96.667 €	39.215 €
Wartung HW p.a.	50.000 €	25.000 €	9.804 €
Leasing OS Lizenzen p.a.	14.667 €	7.333 €	6.667 €
OS Wartung p.a.	19.333 €	9.667 €	22.353 €
Administration Betriebssystem	18.000 €	24.000 €	120.000 €
Summe p. a.	**295.333 €**	**360.706 €**	



New from the Competence Center

SAP PRESS
580 pages
ISBN 1-59229-035-3
expected 08/2005

Questions?



saphpcc.bbn.hp.com